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THE EAST MIDLAND GEOGRAPHER

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No. 13 JUNE 1960

THE URBAN FIELD OF CORBY

D. C. D. Pocock

Investigation of the extent and character of the urban sphere of influence through an application of selected indices is an essential part of the functional analysis of towns. The exercise has both academic and practical value, and is especially interesting where neighbouring centres are growing at unequal rates. Instances of differential rates of growth occur most strikingly where new towns are emerging within the existing urban hierarchy and disrupting the established pattern of urban hinterlands. The present article, describing and analysing the regional effects of the growth of Corby New Town in Northamptonshire, is an example of this dynamic approach to the subject of urban fields. Conditions in the period before Corby's designation as a new town (1950) are compared with those in 1959, revealing changes over a nine-year period during which the population of Corby has doubled and its urban facilities have greatly expanded. In view of the further planned expansion of the town, an attempt is made in the concluding section to define Corby's future urban field.

The Corby area shown in Figure 1 consists of some 200 square miles of the English Midlands, roughly equidistant between the important centres of Leicester, Peterborough and Northampton. Its rocks belong to the Jurassic system, and the most prominent feature is the Great Oolite escarpment north of Corby. To the north of the escarpment is the broad valley of the Welland, the river which forms Northamptonshire's northern boundary. The area is still predominantly devoted to agriculture, although many ironstone workings have been developed, and it is one of sparse rural population. Kettering was for long the only important town, but its role as a regional centre is now being increasingly challenged as a result of the growth of Corby. In impetus behind Corby's growth is the expansion of the iron and steel works of Stewarts and Lloyds, a development which has transformed Corby from a village with 1,500 inhabitants in 1933 to a town with a population of 33,000 in 1959—only 4,000 fewer than Kettering's. In the next three years, moreover, Corby will attain the target of 40,000 set by the Development Corporation, and surpass Kettering in population.

Corby's Growth as a Regional Centre for Economic Functions

Corby's prime regional importance lies in its role as a large employer of labour, a function antedating its creation as a new town and even the erection of the modern iron and steel plant. The number of iron and steel workers at Corby living outside the town has risen from some 250 at the original ironworks in 1932 (1) to over 3,000 at the present day, this high figure arising from the creation of an industrial unit employing 10,000 persons in a former country village. Many people entering the area to work for the firm either were unable to find accommodation in Corby, or chose to live elsewhere on finding that Corby lacked not only

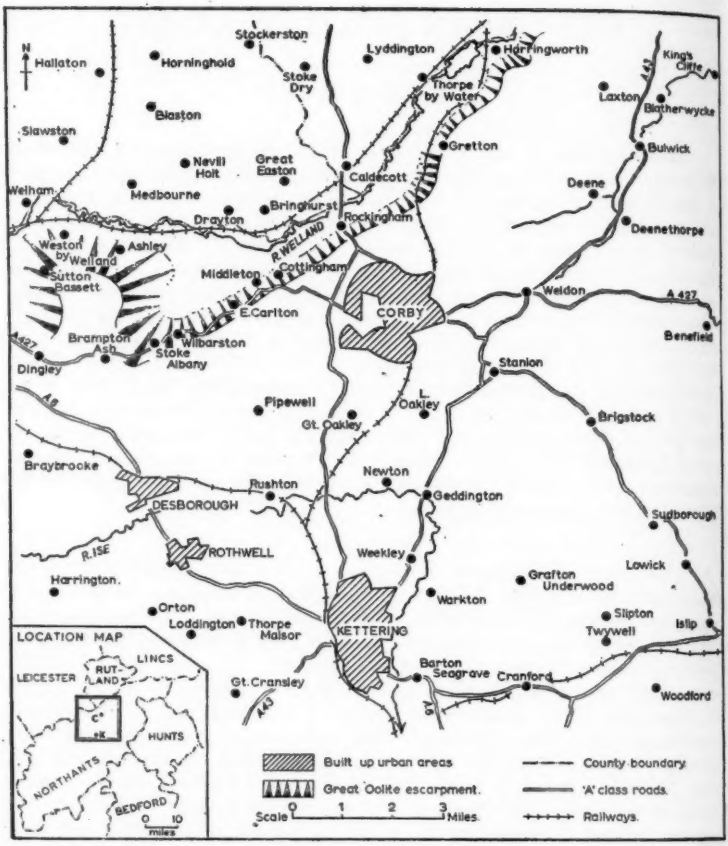

Fig. 1

The Corby area : key map.

many of the accepted urban facilities of a town but also the attractiveness of nearby villages. Although the firm built 2,000 houses in Corby in the pre-war years, it also encouraged residence outside by erecting houses for administrative staff four miles away in the village of East Carlton. The trend was accentuated by the engagement of local people formerly employed in agriculture and other occupations financially less rewarding. Since 1950, however, the daily inward movement of workers has not increased because Corby Development Corporation has provided more housing and improved urban amenities (Table 1)(2).

TABLE 1

RESIDENT AND INCOMING WORKERS OF STEWARTS AND LLOYDS

	Total	*Place of Residence*		
Year	*Employees*	*Corby*	*Elsewhere*	(*Kettering*)
1946	5,610	3,559	2,051	(528)
1950	7,772	4,751	3,021	(963)
1958	10,388	7,267	3,120	(927)

At the time of the 1951 Census Corby had the highest net daily influx of workers of any town in Northamptonshire. The total of 2,840, compared with 787 for Kettering and 2,650 for Northampton, represented 37 per cent. of the town's total of workers, and 96 per cent. were men, who lived mainly in the nearby Borough, and surrounding Rural District, of Kettering (Table 2). For purposes of a more exact delimitation of the employment hinterland, however, the returns for individual villages in a 1946-7 survey by the Ministry of Town and Country Planning(3) are of more value than figures based on the large administrative units used in the Census.

TABLE 2

ORIGIN OF PERSONS WORKING IN CORBY, BUT RESIDENT ELSEWHERE, 1951

Division	*Total*
Kettering R.D.	1,523
Kettering M.B.	1,157
Oundle and Thrapston R.D.	510
Uppingham R.D.	123
Elsewhere	369

Figure 2a shows that Corby's area of domination as a centre of employment encompasses 27 villages, from King's Cliffe in the north to Lowick and Stoke Albany in the south. Its extension southwards is limited by the proximity of Kettering and northwards by rural inaccessibility. The settlements contributing most of the workers are within four or five miles of Corby, situated approximately on the circumference of a circle drawn through Wilbarston, Gretton, Brigstock and Geddington.

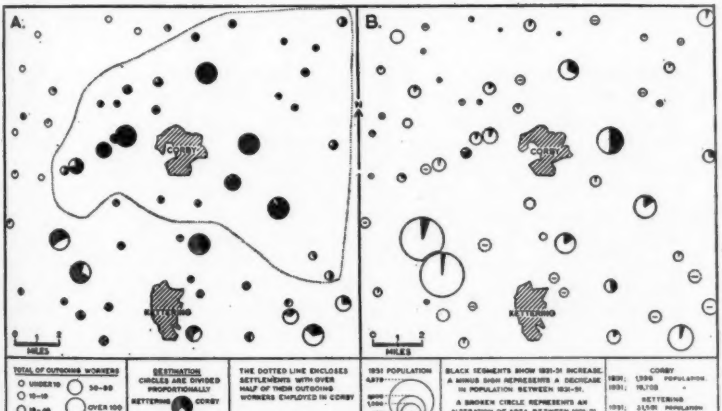

Fig. 2

A—Journey to work in the Corby area, 1947. B—Population change in the Corby area 1931-1951

The growth of the employment hinterland of the new steelworks can be gauged from a map showing population change between 1931 and 1951 (Fig. 2b). Villages with the highest numbers employed in Corby are, with few exceptions, those with the largest intercensal population increases. For instance, five of the six leading villages for which Corby

is the main centre of employment are among the six villages with the most outstanding increases in population since 1931 (Table 3) (4). By contrast, most of the smaller villages declined in population, because of their inaccessibility, poor social provision, or, in isolated instances, the policy of the landowners wishing to prevent the creation of dormitory settlements for industrial Corby.

TABLE 3

VILLAGES WITH HIGHEST NUMBERS OF PERSONS EMPLOYED AT CORBY COMPARED WITH THE GREATEST POPULATION INCREASES IN THE CORBY AREA 1931 – 1951

Number employed in Corby (1947)		*Population increase* 1931–1951	
1. Weldon	217	1. Weldon	837
2. Brigstock	131	2. Gretton	366
3. Gretton	120	3. E. Carlton	199
4. Cottingham	98	4. Brigstock	173
5. E. Carlton	71	5. Geddington ..	163
6. Geddington	59	6. Grafton U.	160

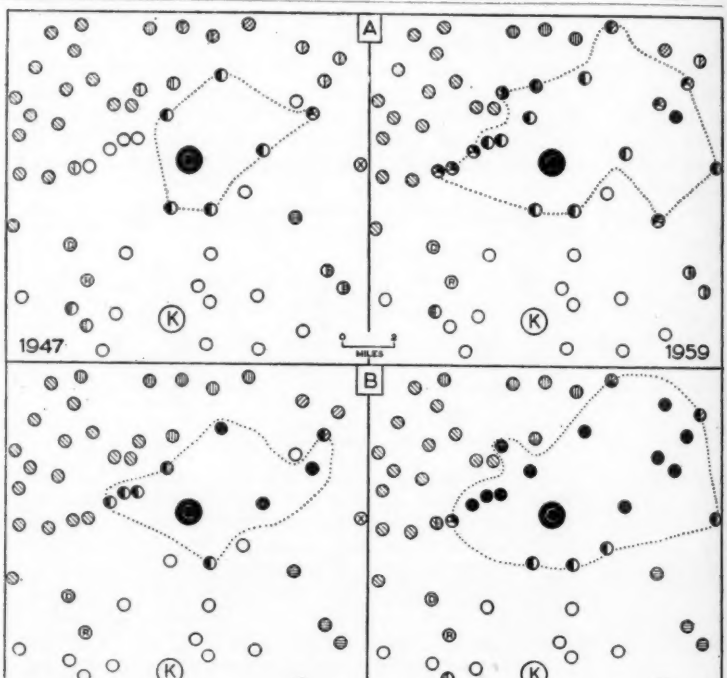

Fig. 3
The 1947 and 1959 service areas for weekly shopping (A) and banking (B).

Corby's influence as a commercial centre is a more recent development which has emerged only since its designation as a new town. Before 1950 not a single village relied exclusively on Corby for its weekly shopping (Fig. 3A) and the town was no more than a subsidiary centre within the larger urban field of Kettering(5). Two national surveys made in 1950 and 1951(6), summarised in Table 4, reveal its meagre development compared with nearby towns. Corby's hinterland population of 780 was dwarfed by the figure for Kettering, estimated at between 19,000 and 21,000, and was even exceeded by those of centres with less than a quarter of the population size of Corby, such as Desborough, Oundle and Uppingham.

TABLE 4

TOTAL RETAIL SALES AND ESTIMATES OF HINTERLANDS SERVED

Centre	1950 *total sales* (£000's)	*Hinterland population* A	B
Kettering	6,370	21,210	18,981
M. Harborough ..	2,081	8,690	7,979
Stamford	2,304	16,990	9,141
Corby	1,532	780	None
Oundle	455	3,360	1,205
Desborough	440	880	None
Rothwell	389	—	None

Column A from *Marketing Areas' Handbook*; column B calculated from *Retail and Service Trade*. The latter is found by dividing total sales of each centre, as recorded in the Board of Trade survey, by the regional per capita expenditure (£113.1 for the North Midland Region) and assuming that any excess over a town's population represents hinterland trade. It provides a useful, if approximate, indication of hinterland size.

The growth of new shopping facilities in Corby, however, has radically altered the situation over the past decade. By 1959 two-thirds of a planned total of one hundred shops, including several large department stores and a "double-decker" shopping block, had been completed in a new town centre, and as a result Corby is proving attractive to several villages which from their very proximity appear to be within the town's natural sphere of influence, but which were formerly orientated elsewhere. Thus Cottingham, Middleton and East Carlton no longer neglect the nearby town. Corby's influence as a shopping centre now extends as far west as Stoke Albany, and as far east and north as Benefield and Harringworth. As a banking centre its influence has extended over a similar territory (Fig. 3B).

Corby's Growth as a Regional Centre for Entertainment and Social Services

The growth or extension of amenities in the new town has likewise created hinterlands of differing extent for the various cultural, entertainment, health and educational services. The two widest hinterlands at present are those for clinic facilities and adult education. The Nuffield Diagnostic Centre, opened in 1954, has further extended the fairly wide area already served by the clinic in Corby in 1947 (Fig. 4A). Twenty-five villages now look to Corby for this service, forming the widest sphere of influence other than the one for employment. Similarly the new technical college has already extended Corby's influence as a

centre for evening or adult education (Fig. 4B), and when its building is completed the college will provide facilities for technical education up to degree standard for a wide area of Northamptonshire.

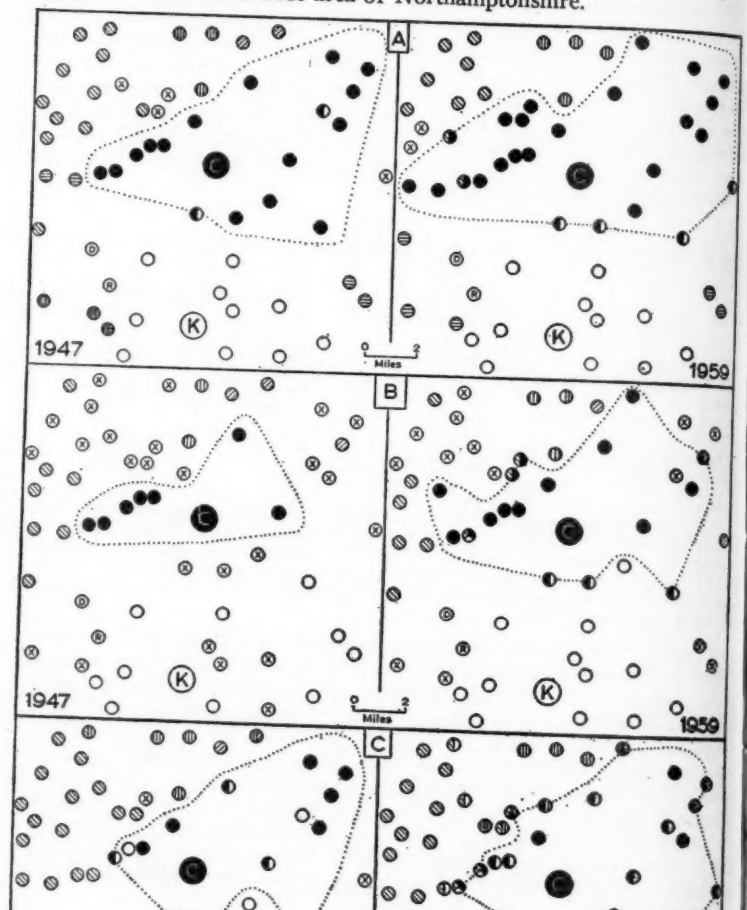

Fig. 4.—The 1947 and 1959 serivce areas for clinic (A), evening education (B) and cinema (C).

The new town is less important as a centre for secondary education, in which catchment areas are laid down by county authority. The areas served by secondary modern and grammar schools coincide except in the west, where Wilbarston and Stoke Albany use the Rothwell secondary modern school. The many new schools built in Corby almost exclusively serve its own educational needs, and the present school pattern of the Corby area is substantially the same as that of 1950. However, an indication of growth is sen in the transference to Corby's first grammar school, opened in 1955, of children from thirteen villages previously served by Kettering (see Fig. 5B).

Also indicative of the town's growing regional influence was the creation in 1954 of the *Corby Leader* newspaper as a separate edition of the *Kettering Leader and Guardian,* in which local news had formerly appeared(8). This weekly newspaper is sold over a compact area between East Carlton, Brigstock and Laxton (Fig. 5A).

As a centre for entertainment or recreation Corby remains unimportant. The nearest theatre is at Northampton, and Corby's only cinema, situated in an old part of the town and badly placed for bus services, has little attraction for people in surrounding villages (Fig. 4C). Although a site for a second cinema has been reserved at the town centre, the Development Corporation has been unable to attract a company in view of the depressed condition of the cinema industry. This, of course, is a nation-wide phenomenon related to the development of television.

The Urban Field in 1959

Corby has become increasingly important to villages in the surrounding countryside during the last few years, and may be said to be creating an urban field whereas in 1947 it exerted only small influence. Different services have created hinterlands of varied size, and Figure 5, showing the 1959 hinterlands for eight selected services, summarises the present territorial extent of Corby's influence(9). Eighteen villages looking to the new town for at least three of the four services of employment, weekly shopping, banking and weekly newspaper are regarded as being encompassed by Corby's economic sphere of influence. Of the fifteen villages with three or more of their education and medical services located at Corby only Stoke Albany and Great Easton are not in the town's economic hinterland. A combination of the two patterns shows that fourteen villages have six or more of the eight services centred on Corby. They are located in an approximately triangular area with its apices at Wilbarston, Brigstock and Harringworth.

East and north-east of Corby the town's economic services dominate more widely than most of its social services, but Corby's influence is felt as far as Benefield and Bulwick. On the north-west side of the triangle Corby in the dominant urban centre of the area extending from Harringworth in the north along the Oolitic escarpment to East Carlton and Wilbarston, but little headway has been made across the river Welland in Leicestershire and Rutland, where population is sparse, and villages small and virtually without bus services. The southern side of the triangle is the most sharply defined, and the only advance into an area strongly within the urban field of Kettering is represented by the south-eastern segment of the employment hinterland.

Although its regional influence has grown, the new town is still at a disadvantage compared with Kettering in several respects. For instance, because of its earlier development, Kettering is the regional centre of roads and railways, and the main focus of bus services. Corby receives only one-third as many buses and only one-sixth as many trains as Kettering. The two most important through roads, the A.6 to Market Harborough, and the A.43 to Stamford, converge on Kettering but do not touch Corby. Again, whereas Kettering has a large hinterland south of the town, the local road and rail system north of Corby is aligned in a north-east to south-west direction parallel to the Welland and is not centred on the town. Kettering also has more shops and associated facilities, while Corby still lacks such amenities as parks, restaurants and cinema, which attract whole families. This particular deficiency however is only a temporary one, and with continued expansion of urban facilities more villages may be expected to turn to the new town for various services.

The Future Urban Field

The aim of Corby Development Corporation is to create "a self-reliant modern active town . . . dependent on other towns neither for its employment and housing nor for its entertainment and culture"([10]). In so doing the corporation will affect the lives of many more people than those within the boundaries of the designated area, and, providing that bus services are revised, it is officially estimated that Corby could become the shopping centre for 60-70,000 people([11]). In support of this estimate it can be shown that the growth of the town's regional influence since 1950 has been accomplished without alteration of bus services, and with only two-thirds of the planned total of shops yet completed. An independent estimate of Corby's future influence as a commercial centre can be made by studying:

(*a*) the relative location, size and facilities offered by other towns; and

(*b*) the established routes and transport services, particularly bus services, and suggested revisions in the light of Corby's planned development, and of the location of surrounding villages.

Kettering, immediately south of Corby, is its nearest and most important rival (Table 5). In a 1944 classification of towns([12]) into an urban hierarchy based on range of urban facilities Kettering was designated a "Major Town" in a class higher than either Stamford or Market Harborough. Corby was unclassified, and ranked only as a "Sub-town". Kettering, with the area's servicing garage of the United Counties bus company, is the chief operating centre for bus services in northern Northamptonshire. Its 680 shops far outnumber the present and planned totals for Corby, although it is true that many are small street-corner stores of no interest to visiting shoppers, while Corby has the advantage of greater concentration at a planned town centre. Nevertheless, its many shops and three (formerly four) cinemas, regional general hospital and daily evening newspaper indicate that Kettering is the more important urban centre.

TABLE 5

URBAN CENTRES IN THE CORBY AREA

Centre	*Population*	*Shops*	*Cinemas*	*Hospital*
Corby	33,000	216	1	—
Kettering	36,799	686	3	Yes
Stamford	10,899	261	1	Yes
M. Harborough	10,401	185	2	Yes
Uppingham	1,868	54	1	—
Oundle	2,224	50	1	—
Thrapston	1,798	44	1	—
Desborough	4,676	79	—	—
Rothwell	4,614	73	—	—

Stamford, 15 miles to the north-east, and Market Harborough, 11 miles to the west, are both old and fairly small market towns with their own established service areas in parts of which Corby now competes. Market Harborough, nearer to Corby and possessing fewer shops than Stamford, is the more likely to suffer from the competition of the new town. The west to east A.427 road directly links Market Harborough with Corby, and the concentration of villages along it could favour an increase of bus services.

Within the service hinterlands of the large urban centres four smaller towns are complicating elements particularly in relation to day-to-day requirements. Uppingham, 7 miles north of Corby, is an attractive centre for villages in southern Rutland and even as far as Rockingham village. Oundle, 9 miles to the east, attracts only Benefield of the villages under review, but Desborough and Rothwell are important local centres for various services south-west of Corby.

Corby will soon surpass Kettering in size to become the largest town in the county after Northampton, but neither its population nor shopping facilities will be substantially greater than those of Kettering. The new town will not achieve a rank superior to Kettering's in the urban hierarchy and for several functions will remain definitely subsidiary to the older settlement. No fundamental change in orientation therefore can be foreseen in those villages situated nearer to Kettering than to Corby. More headway may be made in other directions, and this possibility can be briefly discussed (Fig. 5).

Thirteen villages with just over 5,000 people constitute the present hinterland of Corby, that is, the area in which Corby is the dominant centre to which people look for their weekly shopping needs (Table 6).

For all these villages the new town is the nearest urban centre, and only Stanion and Little Oakley are served by a greater number of buses running to another centre. In the north-east where equal numbers of buses run to Stamford and Corby the journey to the latter is much the shorter.

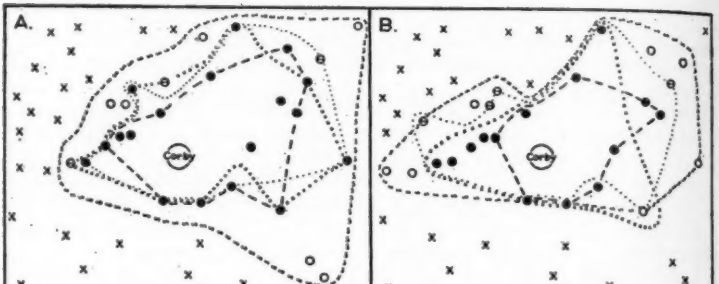

Fig. 5

A—The present hinterland of Corby for selected economic facilities. B—The present hinterland for selected social facilities. C—The probable and possible future extensions of the hinterland.

TABLE 6

VILLAGES IN CORBY'S PRESENT HINTERLAND

Village	*No. of buses and time for journey to:* (*a*) *Corby*	(*b*) *next centre*	*Services to other centres within 40 mins.*	*Popn.*
E. Carlton ..	9 (15 mins.)	D.4 (19 mins.)	K M U	260
Middleton „ ..	9 (13)	D.4 (21)	K M U	290
Cottingham ..	9 (10)	D.4 (23)	K M U	606
Gretton ..	3 (15)	— —	—	1,036
Gt. Oakley ..	19 (10)	K.18 (15)	—	172
Weldon .	20 (8)	O.4 (24)	K	1,648
Deene .	4 (15)	K.4 (40)	S	129
Deenethorpe .	4 (15)	K.4 (40)	S	65
Bulwick .	4 (20)	S.4 (35)	—	213
Blatherwycke ..	4 (25)	S.4 (30)	—	81
Laxton ..	4 (25)	S.4 (33)	—	123
Stanion ..	15 (9)	K.27 (22)	T	305
L. Oakley ..	15 (13)	K.27 (18)	T	100

Bus figures are for the number arriving at a centre on Saturdays between 9.30 a.m. and 4.30 p.m. where the journey does not exceed 45 minutes. Centres are represented by the following letters : C (Corby) ; D (Desborough) ; K (Kettering) ; M (Market Harborough); O (Oundle); R (Rothwell); S (Stamford); T (Thrapston); U (Uppingham).

Other villages are as yet less strongly orientated towards Corby, but on account of their locations, Corby's expansion and possible bus service revision, they may fall within the new town's sphere of influence in the future. This group can be subdivided according to whether Corby's future dominance seems "probable" or merely "possible."

TABLE 7

VILLAGES IN CORBY'S PROBABLE FUTURE HINTERLAND

Village	*No. of buses and time for journey to:* (a) *Corby*	(b) *other centres*	1959 *Village Survey*	*Popn.*
Wilbarston ..	6 (22 mins.)	D.5 (13); M.6 (19); U.	C K M	497
Stoke Albany ..	6 (25)	D.5 (11); M.6 (17); U.	C K M	257
Brampton Ash	2 (27)	M.6 (13)	M	173
Rockingham ..		U.4 (20); M.2 (35)	C K	193
Caldecott ..		U.4 (16); M.2 (39)	C U	206
Benefield ..	3 (20)	O.4 (12)	C O	467
Brigstock ..		T.2 (21); K.5 (32)	C K T	1,098
Sudborough ..		T.2 (12); K.2 (41)	K T	189
Lowick ..		T.2 (8); K.2 (44)	K T	365

The probable future hinterland comprises nine villages, with a combined population of 3,450 (Table 7). In the west Wilbarston and Stoke Albany are approximately equidistant from Corby and Market Harborough, have equal numbers of buses to each centre, and in 1959 used no one dominant town for weekly shopping. Brampton Ash might also be included, but the villages further west are within a ten-minute journey of Market Horborough. To the north Rockingham and Caldecott have no buses at all to Corby despite their close proximity. The service is aligned between Uppingham, where there are limited shopping facilities, and Market Harborough, which is three times more distant than Corby. Eastwards, Benefield is nearer the minor centre of Oundle, but the 1959 survey showed that allegiance is already divided. Brigstock, Sudborough and Lowick are nearer, by good class road, to Corby than to Kettering, but all three are at present orientated by their bus services into the commercial sphere of influence of Kettering and, to a lesser extent. Thrapston. But the service, established when Corby was no more than a village, may be diverted, at least partially, to follow a more rational course than the present one, which runs to within 1½ miles of Corby's boundary before turning south at Stanion to make the six mile journey to Kettering.

TABLE 8

VILLAGES IN CORBY'S POSSIBLE FUTURE HINTERLAND

Village	*Bus service*	1959 *Village Survey*	*Population*
Bringhurst	—	M	55
Gt. Easton	—	M C	398
Drayton	—	M	99
Nevill Holt	—	M	42
Medbourne	—	M	398
Ashley	—	M	181
Thorpe by Water	—	U	34
Harringworth	—	S C	162
Liddington	U.4 (7 mins.)	U	309

The nine villages in a possible hinterland are all north of the settlements in the present and probable future zones, for no further expansion is likely in any other direction. In the west settlements are within three miles of Market Harborough; in the east there is no settlement beyond Benefield until the Nene valley is approached, and then orientation is towards Peterborough or Oundle. In the south Kettering's influence will remain overwhelmingly dominant.

North of the Oolitic escarpment is a wide area containing small villages, many with populations of less than one hundred, which are without bus services, and for which the larger villages of Great Easton, Medbourne and Hallaton act as local service centres. The sparse and dispersed population relies on van delivery services, and any development of an adequate public transport system is precluded. On account of their location however nine of the villages are considered to lie within the possible future hinterland. It may be argued that Corby's influence will not extend so far; it may be definitely stated that this possible northward extension will add no large increment to the population served by Corby, for the nine settlements have a combined population of only 1,670. Thus the potential hinterland contains 5,000 persons, which, added to the present hinterland, brings the total number of persons in the surrounding villages to approximately 10,000.

Conclusions

Bearing in mind the additional facilities available by 1963 when Corby will reach its population target of 40,000, two broad conclusions follow from this study. Firstly, the town will be a reasonably self-contained community, but will continue to look to Kettering for certain services like hospital facilities, daily evening paper and cinema entertainment.

Secondly, although Corby already acts for a wide area as the centre for certain facilities such as employment and clinical services, it seems probable that its regional influence as a commercial centre will only develop further within limited bounds, absorbing the northern section of Kettering's urban field and the smaller eastern section of Market Harborough's territory. This is the area which town size alone suggests should be within the service hinterland of Corby but which in the recent past has been unaffected by this sizeable but ill-provisioned town. Corby's future facilities, however, will not be inherently superior to those of Kettering, although it remains to be seen whether the convenience of a planned grouping of the shopping units will give the new town any significant advantage. The wider range of its facilities compared with the smaller towns of Market Harborough and Stamford will always be partly counterbalanced by distance and sparseness of the rural population in much of the potential hinterland. The future hinterland population has therefore been estimated at 10,000, compared with the official estimate of 20-30,000, and unless an entirely different standard of measurement has been used the official figure appears to be excessive.

NOTES

(1) *Annual Report upon the Health of Kettering: 1933*, (1934) p. 31.

(2) The total employees figure includes some 600 quarrymen, many of whom in fact live in surrounding villages and do not therefore enter Corby for their employment.

(3) *Journey to Work Survey: Northamptonshire*, Ministry of Town and Country Planning, North Midland Region, 1947 (Unpublished). Although the country had not fully returned to conditions of peacetime the survey is a useful source of information.

(4) The only notable exception is Grafton Underwood which has developed as a dormitory settlement for Kettering.

(5) Green's conclusion from a study of 1947-48 bus services that "Corby in Northamptonshire well illustrates the tendency for a newly developed work centre to become also a shopping and entertainment centre" may therefore be seen to be premature. (F. H. W. GREEN, "Urban hinterlands in England and Wales : an analysis of bus services, "*Geographical Journal*, 116 (1950) p. 75).

(6) "Retail and Service Trades, 1950" Vol. I of *Census of Distribution and other Services*, Board of Trade, H.M.S.O. (1953). *Marketing Areas Handbook*, published by Geographia Ltd., London (1955).

(7) The clinic is a more relevant medical index at this level of analysis than either doctors' areas or nurses' districts, both of which are small and localised, or general hospital regions which extend over wide areas. Similarly, hinterlands for secondary and technical education are of more value than primary school areas.

(8) At the end of 1959 Northamptonshire Newspapers Ltd. (Kettering) reorganised their various weekly editions under a general heading of the *Northamptonshire Advertiser*.

(9) The present map makes no differentiation between villages recording Corby and those recording additional alternative centres, and it is realised that Corby is not the only service centre for *all* the enclosed settlements.

(10) R. F. BROOKS-GRUNDY, *Corby New Town* (1957) p. 16.

(11) R. F. BROOKS-GRUNDY, in a talk to the East Midland Group of the Royal Institute of Public Administration, 7th March 1958. The *Corby Leader* for 16 May 1958 reported Mr. Brooks-Grundy as saying that before long Corby would rank higher than Kettering as a shopping centre. For a comparison of estimates of other new town hinterlands see D. C. D. POCOCK "Growth of British New Towns" *Tijschrift voor Economische en Sociale Geografie*, 51, No. 1 (January 1960) p. 7.

(12) A. E. SMAILES, "The Urban Hierarchy of England and Wales", *Geography*, 29 (1944) 41-51. The omission of Corby suggests that 1931 data were used.

THE LEICESTERSHIRE AND SOUTH DERBYSHIRE COALFIELD

(3) Light Industry

W. D. HOLMES

The important coal mining and clay working industries have already been described(1); they employ 68 per cent. of the insured workers in the primary and secondary industries(2). The remaining secondary industries consist of a group of engineering firms which employ 13.5 per cent. of the primary and secondary labour force, followed in order of importance by textile industries (5.6 per cent.), food industries (4.4 per cent.), clothing and footwear industries (2.5 per cent.), and miscellaneous industries (2.8 per cent.). In contrast to the coal and clay industries, which owe their existence to the geological resources of the region, the remaining secondary industries show a location which illustrates the importance of labour, markets, and available factory accommodation. In 1954 there were 65 firms employing over 10 people. Of these, 35 employed fewer than 50; 11 between 50 and 100; 16 between 100 and 500; and only 3 over 500. The factories are therefore mainly small, and many of them have parent organizations in other areas, especially Leicester. They are mainly engaged either in producing material and accessories for use elsewhere in the United Kingdom or in assembling semi-finished products, as in the case of the boot and shoe, clothing, and some of the engineering industries. Together, they constitute the light industry of the coalfield.

ENGINEERING INDUSTRIES

Although the absence of iron ore and coking coal prevented the development of any early local iron industry, engineering activities nevertheless have a history going back to the early nineteenth century, when they included the manufacture of boiler equipment for use in local collieries and clay works and in the Burton-on-Trent breweries. During the nineteenth century they expanded in size and scope to include the building and maintenance of railway rolling stock, and by the beginning of the twentieth century textile machinery was being manufactured for use in the Leicester hosiery and knitwear factories. However, up to 1939, the engineering industries remained relatively unimportant and were chiefly concerned with meeting local requirements.

The war time policy of dispersing industry led to many new factories being sited in the region as branches of such firms as Vickers, Daimler, Dunlop and British Timkin. When these branches closed down at the end of the war they left behind a variety of factory accommodation and some skilled and semi-skilled labour, both of which have been utilized during a post-war extension of industry into the region from other centres in the Midlands. The character of the present industries differs from that of the pre-war period, and the influence of local markets is much less important. The manufacture and repair of clay-working machinery and rolling stock now occupies less than one-tenth of the engineering labour, whereas the production of textile machinery

has become one of the major engineering activities on the coalfield, Coalville to-day containing one of the largest latch needle factories in the country. Other products include quarry machinery and pumps, tubes for general engineering purposes, parts and accessories for the motor vehicle, aircraft and electrical industries, and small metal ware assemblies. Much of this production is used in other midland industries.

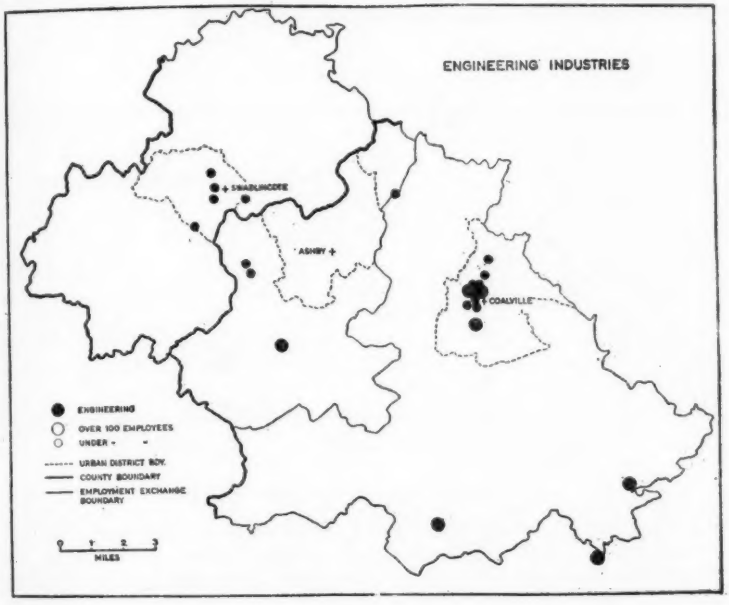

Fig. 1

The engineering industries have continued to expand since 1938, when they employed 3 per cent. of the primary and secondary labour. In 1945 the figure rose to 10.4 per cent., and in 1958 it was 13.5 per cent., *i.e.*, over 4,400 employees, which is almost the same number as were then engaged in the clay industry. The industry is concentrated in Coalville Urban District, where half the engineering labour is employed. The Western Basin mainly contains small firms of pre-war origin engaged in general engineering and the manufacture of clay machinery.

Textile, Clothing and Footwear Industries

The textile industry may be said to have its antecedents in the local domestic hosiery industry and in certain early nineteenth century cotton and silk factories, for example at Measham. In the latter half of the nineteenth century the manufacture of elastic-sided boots in Leicester, and of corsets in Market Harborough, resulted in the building of an elastic web factory at Coalville in 1872 to help supply these trades. This was the forerunner of the large narrow-fabric factories which dominate the textile industry of the coalfield today. Four narrow elastic fabric

factories and one zip-fastener fabric factory now employ three-quarters of the textile labour, and Coalville is one of the most important centres in the United Kingdom for the manufacture of narrow elastic web. These narrow fabrics are extensively used in the clothing trade, and the region is centrally situated in the country to serve manufacturers in London, Nottingham, Leeds, and the Tweed Basin. The remaining textile workers are employed in four hosiery and knitwear factories, two of which are post-war branches of firms in Leicester and Loughborough which required additional accommodation and labour.

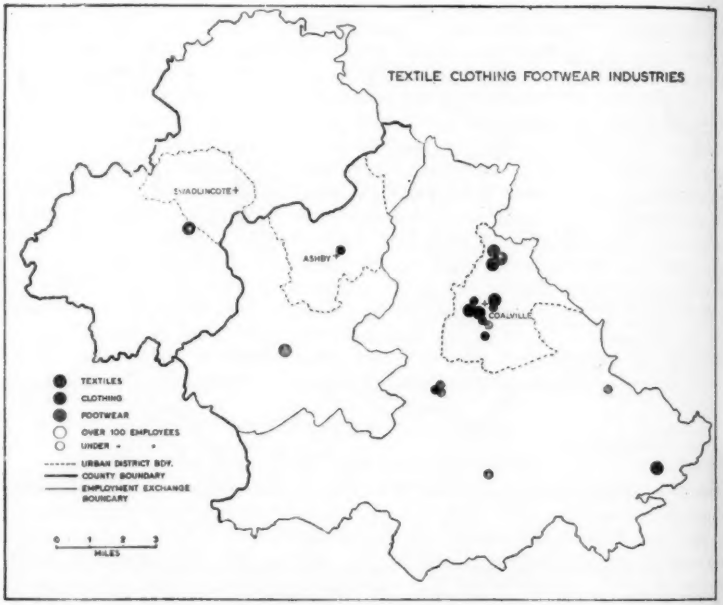

Fig. 2

The number of employees in textiles dropped during the war but rose again to the pre-war percentage of primary and secondary labour, *i.e.*, about 6 per cent., at which level it has remained fairly steady. Ninety per cent. of the industry is located in the Eastern Basin, most of it in Coalville Urban District. This location is naturally an advantage to an industry which has many connections with Leicester and Loughborough.

The clothing and footwear industries are relatively unimportant. Most of them originated in Leicester and are situated in the Eastern Basin.

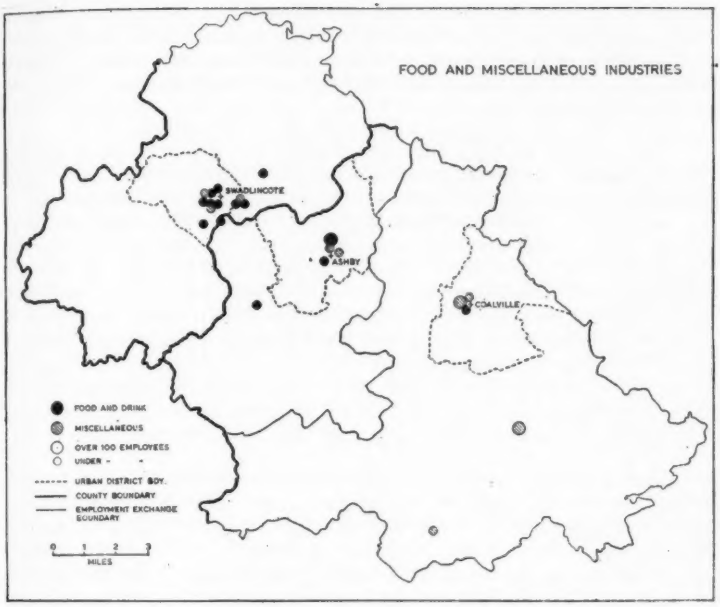

Fig. 3

Food and Miscellaneous Industries

The outstanding feature of the food industries is the dominance of one large biscuit manufacturing firm in Ashby-de-la-Zouch which employs over half the labour force in this occupational group. It moved here from London in 1928 in order to be more centrally situated and to employ the available female labour. It has expanded considerably since the war and its products have a country-wide distribution. None of the remaining food and drink manufacturers, who provide almost entirely for local consumption, employs more than 60 people.

The two largest factories in the miscellaneous group of industries are situated in the Eastern Basin and together employ over half the labour in this category; they manufacture plastics, including toys, and rubber components. The remaining industries are small and involve rubber, soap, upholstery and printing and publishing.

The distribution of light industry within the coalfield region reveals a marked concentration in the Eastern Basin and in particular in Coalville Urban District. The Coalville Employment Exchange Area, which approximates to the Eastern Basin, contains 70 per cent. of the employees engaged in the light industries, the Urban District itself including almost 40 per cent.(3). The Urban Districts of Swadlincote and Ashby have smaller concentrations. The importance of the Eastern Basin results mainly from its nearness to the large industrial city of Leicester and from the greater population on this side of the coalfield. The importance of the three Urban Districts is likewise due to their large

populations; 48 per cent. of the total population in the Employment Exchange Areas live in these towns, and almost half of this figure relates to Coalville. Furthermore these three towns are the focus of public transport services and thus draw additional labour from the surrounding villages.

The growth of light industry during the 20 years since 1938 is reflected in the employment statistics. In 1938 14.9 per cent. (3,600 people) of the primary and secondary labour force was engaged in this type of industry compared with 28.8 per cent. (9,400 people) in 1958. During this period the total number of insured female workers has almost doubled and the proportion of women employed in primary and secondary industries has increased from 13.9 to 18.1 per cent. Approximately two-thirds of the total female labour force is engaged in primary and secondary industries, and of these 35 per cent. work in textile, clothing and footwear industries in which over 80 per cent. of the operatives are women, 15 per cent. in engineering industries (21 per cent. of the operatives women), and 22 per cent. in the food, drink, and miscellaneous industries (over half the total employees women).

Despite the increase in the employment of women they represent only 23 per cent. of the total insured labour force. This is a relatively low figure compared with the national average of about 35 per cent., and suggests the existence of a reservoir of female labour in the coalfield area, which in fact is not the case. This is explained by the great variety of work available in Leicester and the advantages of working in a city with many more amenities than any of the coalfield towns can offer. For these reasons large numbers of women and girls are attracted away from Coalville and the villages in the Eastern Basin. A contributory factor is that a number of miners who live in Leicester find it more convenient to travel to work themselves in order that their wives and daughters may find employment near to their homes in the city. Throughout the coalfield there is little evidence of surplus female labour, particularly on the Coalville side, and enquiries reveal that some of the large post-war firms are experiencing difficulty in increasing their labour force.

Conclusions

This brief review of the nature and origin of light industry in the Leicestershire and South Derbyshire coalfield has indicated the importance of certain factors in its development. These may be summarised as follows:—

(1) The requirements of collieries, clay works and railways in the nineteenth century encouraged the development of engineering industries. By the twentieth century these had increased in size and number to include the manufacture of textile machinery.

(2) The important heavy industries of coal mining and clay working meant that there was a surplus of female labour. This attracted textile, clothing, footwear and other miscellaneous industries, especially from Leicester.

(3) The factory accommodation and labour which remained after 1945, when the war-time industries began to move back to their original locations, were quickly taken up by an influx of new industry, principally from areas where war-time damage, labour shortages, and building restrictions prevented expansion. Firms from Leicester, Birmingham and London moved into the area.

(4) The central position of the region in industrial England permits easy access to neighbouring markets for the many components and accessories manufactured on the coalfield.

Several of the present-day light industries still retain their early connections with local markets on the coalfield, but the general tendency is for the textile, clothing and footwear industries, and particularly the engineering industry, to supply wider markets in the United Kingdom and overseas. The engineering industry has increased in size considerably since the war, and it will soon replace the clay industry as the second largest field of employment on the coalfield. Despite the post-war growth of these secondary industries there is no marked industrial diversification on the coalfield, 50 per cent. of the insured population being still engaged in the extractive industries of coal mining, quarrying, and clay working, with only 26 per cent. in tertiary industries, compared with a national average of about 50 per cent. There is a great demand for labour, especially female labour, and its availability will be a deciding factor in the future growth of light industry.

NOTES

(1) *East Midland Geographer*, 10 (Dec. 1958) 16–26 and 12 (Dec. 1959) 9–25.

(2) Employment statistics have been provided by the Ministry of Labour, and, unless otherwise stated, refer to 1958.

(3) These figures refer to 1954. The Employment Exchange Area was enlarged in 1957 to include the former Ashby Employment Exchange Area.

THE EROSION OF BLANKET PEAT IN THE SOUTHERN PENNINES

MARGARET BOWER

In the part of the Pennines lying to the south of Longdendale, blanket peat has developed extensively. Over large areas it is being eroded at the present time and the purpose of this paper is to discuss the nature and distribution of active erosion. The peat moors(1) occupy much of the flat and gently sloping ground above 1300-1500 feet O.D. The area with which we are concerned is entirely on rocks of the Millstone Grit Series; the limestone outcrop of the Derbyshire Dome is excluded, for despite the high rainfall peat is rare because of the base-richness of the soils and free drainage of the surface.

THE DEVELOPMENT AND DISTRIBUTION OF BLANKET PEAT BOGS IN THE SOUTHERN PENNINES

Three main factors limit and control the development of blanket peat by their influence on surface drainage. Climate imposes the background limits, within which landforms and rock types determine the detailed distribution and the type and depth of peat. In this area geology acts indirectly through its influence on landforms, so that to some extent the two may be considered together. It has some influence also as the parent material of the soil which preceded peat development.

Rainfall, or, more precisely, the precipitation/evaporation balance, is the most important climatic factor, and in this area blanket peat is now common above 1300-1500 feet O.D., where the annual rainfall normally exceeds 40-50 inches(2). With this high rainfall there is a tendency for surface waterlogging to occur over the whole area, leading to the development of a blanket of peat. The general distribution of peat is clearly related to the distribution of rainfall. The rainfall generally increases with altitude, and peat has developed most extensively and is deepest in the highest and wettest areas (Fig. 1). The moorlands on the gritstone to the east and west of the Carboniferous Limestone inlier are fairly low (900-1000 feet O.D.) and have less than 40-50 inches of rain a year. Deep peat is rare and erosion uncommon; often there is a rather thin and peaty soil, for example on Totley Moor and White Edge. To the south-west, in the Axe Edge-Black Edge district west of Buxton, the rainfall is generally between 50 and 60 inches a year above about 1500 feet O.D., and peat of moderate depth has developed extensively (Fig. 2). The average depth on flat areas is probably about 5 feet. In the main block of moorland to the north of Edale peat is usual except on steep slopes and in the lower, drier parts of the valleys (Fig. 1). It is often more than 6 feet deep on the high plateaux of Bleaklow and Kinderscout, where the annual rainfall of the district reaches its maximum of 60-70 inches, but on the lower moors this depth is not often exceeded.

The typical landforms of this area will be discussed briefly, for within the limits set by climate they influence the detailed distribution of

Fig. 1

The distribution of active peat erosion in the Pennines between Longdendale and Edale. Key as for Figure 2.

the peat. Slope, acting through its influence on surface drainage, is the most important factor. This is because the maintenance of free surface drainage is essential if peat bog is not to form in an area where the rainfall is several times greater than the water loss by evaporation from

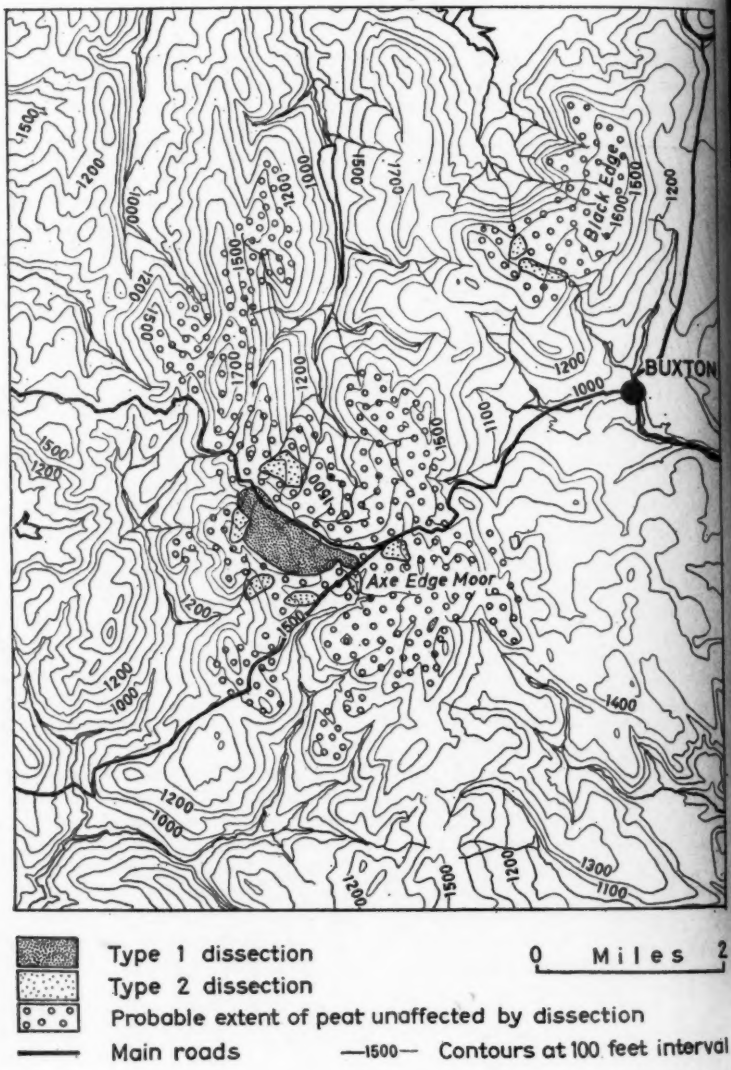

Fig. 2

The distribution of active peat erosion in the Axe Edge—Black Hill district near Buxton.

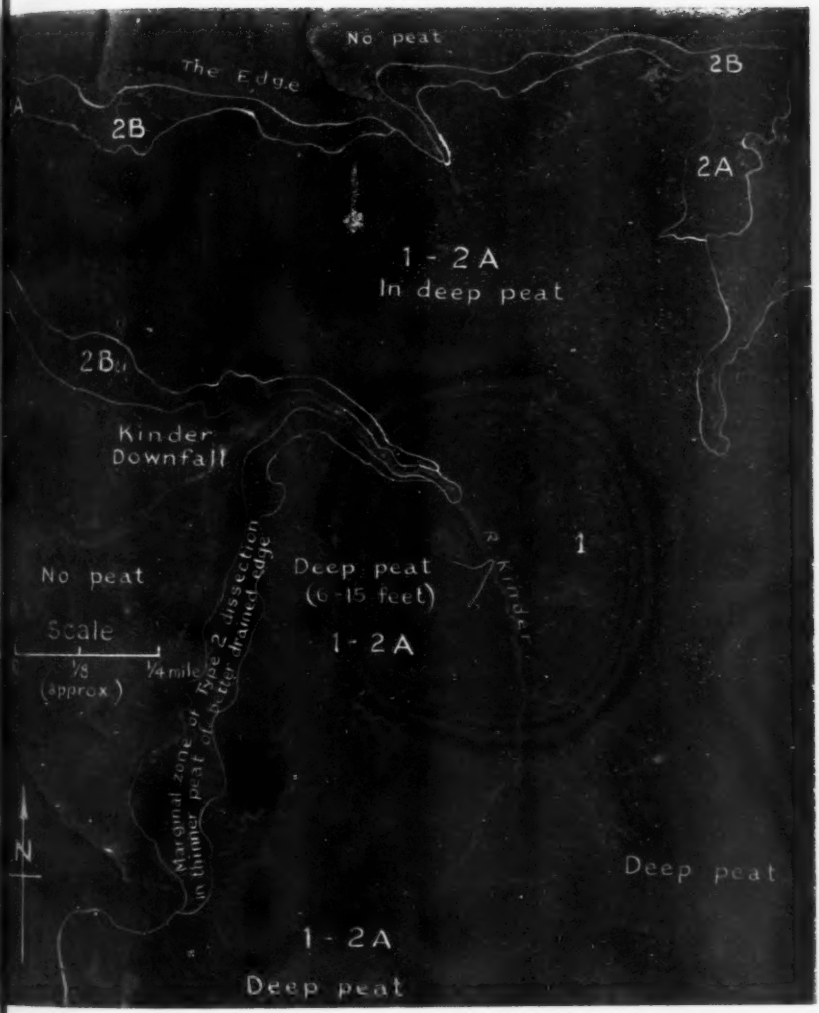

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Plate 1

Extensive development of the two types of dissection on the western part of the Kinderscout plateau. Peat is absent from the steep slopes surrounding the plateau, but is frequently very deep on the plateau itself. Dissection is often well advanced at the present time.

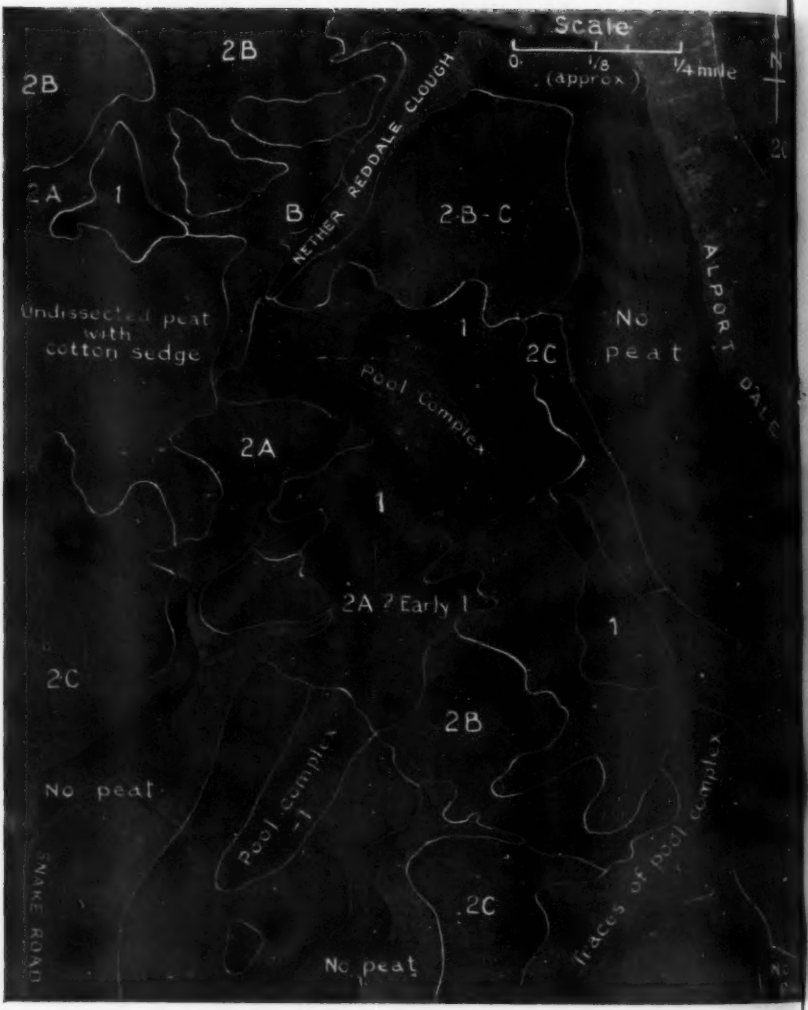

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Plate 2

Extensive peat development on the lower moors between the Ashop and Alport valleys. Large areas of peat show little or no erosion at the present time—the lighter coloured areas on the photograph, where cotton sedge is usually abundant. Peat is absent from the sides of the deeply incised valleys. Type 2 dissection is fairly common towards the edges of the interfluves ; Type 1 is generally confined to the flattest central sector of the interfluve and is often in an early stage. Traces of a pool complex may be discerned, often in areas adjacent to Type 1 dissection.

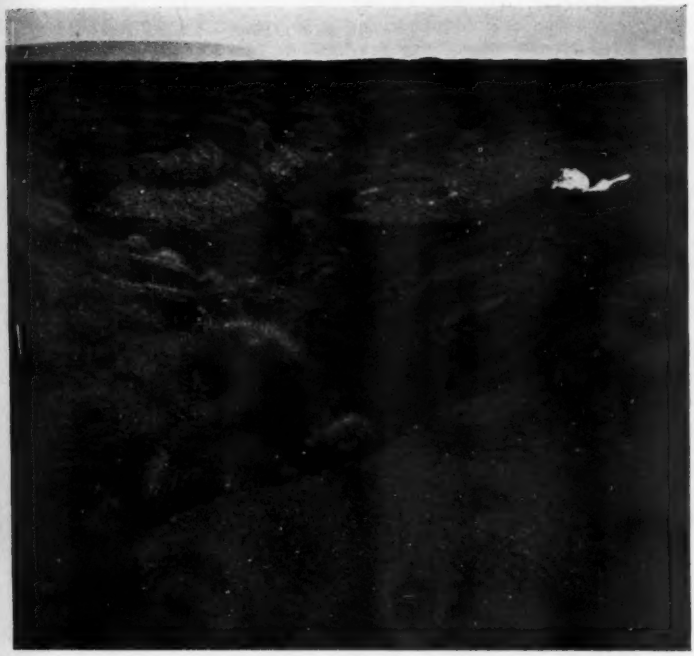

Plate 3

Extensive and advanced Type 1 dissection on Bleaklow plateau. Many of the gullies have incised to the peat base, and the peat blanket has been reduced to a large number of islands.

Plate 4

The development of mud pools on the flat surface of deep peat with cotton sedge vegetation. *Eriophorum vaginatum* is dominant and very tussocky. If such a surface slopes, sheet erosion by rain-wash seems likely to occur. Lower moors, Southern Pennines.

the ground surface. Rock type and geological structure act largely through their influence on landforms. The rock exerts an influence also as the parent material of the soils which preceded the peat. The coarse texture and acidity of soils developed on gritstone probably aid leaching, and favour the onset of peat formation.

In the southern part of the Pennines the landforms have been much influenced by geological structure and lithology. Structurally the area is dominated by the Derbyshire Dome, whose crest is marked by the inlier of limestone. From it the Millstone Grit and Coal Measures generally dip away gently, although in some places they lie horizontally. The Millstone Grit Series comprises a succession of alternating rock types; gritstone and sandstone on the one hand and shales on the other. These vary markedly in their resistance to erosion, so that where they are juxtaposed differential sculpture is probable. Many valleys are deeply incised into these gently dipping strata. Reflecting the structure and lithology many valley and hill slopes are terraced: the benches are capped by gritstone, and the steeper slope between them marks the outcrop of the less resistant shale. The flat topped summit and interfluve and the valley-side bench are very typical landforms of the area, and they are often the sites on which peat has formed; thus the slope map is reflected in the peat map. Together these sites comprise a very large extent of flat and gently sloping ground within the area where rainfall is adequate for peat bog development.

Even in the highest rainfall areas peat is not usual on slopes exceeding 20 degrees. Such a slope is adequate to maintain surface drainage and so prevent peat bog development. As rainfall diminishes so also does the limiting slope for peat; where the annual rainfall is only 50 inches peat is often absent from much gentler slopes. Within the limits of the influence of rainfall, the flatter the ground the greater the depth of peat at the present time. The lower altitudinal limit of the peat is sometimes very high because of the steepness of valley-side slopes: on parts of Kinderscout it is about 2,000 feet.

While the existing distribution and depth of peat can be related generally to present climatic distributions, to some extent modified in their influence by slope and rock type, peat development has extended over a long period during which climatic changes have occurred. While temperatures and rainfall have altered, it is assumed, largely on account of lack of evidence to the contrary, that their distributions have been in the past similar to those at present. In other words, the wettest and coldest areas of to-day were the wettest and coldest in the past. According to Dr. V. M. Conway(3) peat has developed in the wetter parts of the area since the Boreal—Atlantic transition of about 6,000 B.C. Both the extent and rate of accumulation increased as a result of the climatic deterioration of the Sub-Atlantic period, about 500 B.C., although in some places the rate of peat formation increased before this date. Dr. Conway suggests that the well compacted lower layers of the deeper peats of Bleaklow and Kinderscout are of Atlantic—Sub-Boreal age, while their upper layers, which are soft and poorly compacted, suggesting rapid accumulation, are largely of Sub-Atlantic origin. Most of the thinner peats of the lower moors date from the Sub-Atlantic.

The present vegetation of the peat bog surface varies. This is attributable to both physical and biotic factors, and in some places the vegetation is thought to have undergone comparatively recent change. Over large areas of the lower moors, where erosion is not advanced, cotton-sedge (*Eriophorum*) is abundant (Plate 2), for example between Bleaklow and Kinderscout and in the Axe Edge area. The sheathed cotton-sedge (*Eriophorum vaginatum*) is usually abundant, and is accompanied by wavy hair-grass (*Deschampsia flexuosa*) with concentrations of the narrow leaved cotton-sedge (*E. angustifolium*) in the wetter places. The cotton-sedges have probably replaced a more natural and mixed type of vegetation during the last 100 to 150 years as a result of biotic activity, especially burning and grazing(4,5). The role of atmospheric pollution in such vegetation changes appears to be uncertain. Sphagnum, an important peat former in many blanket bogs with more "natural" vegetation, is absent from this area except in a few wet flushes(6), and again this may be attributable to biotic activity. A major exception to the predominence of cotton-sedge on the lower peat moors is found in Upper Derwentdale, in, for example, Harden Moss, as C. E. Moss noted(7). Here there is a much greater variety of plant species than on the cotton-sedge moors; Sphagnum is absent, but ling (*Calluna vulgaris*) and the two cotton-sedges are abundant, while bilberry (*Vaccinium myrtillus*) and crowberry (*Empetrum nigrum*) are frequent. On the highest moors, where erosion is often advanced, the surface vegetation at the present time is often dominated by bilberry and crowberry or, in some places, by ling, together with varying amounts of cotton-sedges and grasses which are, however, rarely dominant.

Types of Erosion in Blanket Peat

In this area several types of erosion system have been recognised on the basis of differences in the forms and patterns of the features resulting from erosion. These contrasts are related to different processes of erosion and differences in the nature of the peat, and they are much influenced, particularly in distribution, by climate and landforms (Figs. 1 and 2, Plates 1 and 2). They are additional to contrasts due to the stage in erosion reached at the present time. The types of erosion have been discussed elsewhere(8) and only a summary is presented here.

There are two main processes of erosion; erosion by water, and erosion by mass movement of the peat.

I. Water Erosion can proceed in any of three ways; by dissection, sheet erosion, or the development of marginal faces.

(*a*) *Dissection.* This is by far the most important type of erosion in the Pennines, and the only one which could be mapped consistently (Figs. 1 and 2). There are two main types (Fig. 3, Plates 1 and 2).

Type 1 dissection is restricted to peat at least 5 to 7 feet deep on slopes of less than 5 degrees (Fig. 3, Plate 3). The pattern of the gullies is exceedingly close and intricate, for individual gullies branch freely and have sinuous courses. As this type of dissection progresses the gullies incise to the base of the peat and develop tributaries, until the former peat blanket is reduced to a large number of

"islands" (Plate 3). In Type 1 dissection many of the gullies, if traced to their heads, are found to begin in pools or depressions on the peat surface. As headward erosion continues the gully cuts back along the line of the pool or depression. Advanced stages of this type of dissection are common on Bleaklow and Kinderscout (Plate 3), and in some places the peat has been almost completely removed, as at Bleaklow Head. Early stages, with few gullies cutting to the peat base, are seen in the flattest central part of some of the lower watersheds between deeply incised valleys, as, for example, round the head of Derwentdale, and in the Axe Edge district (Figs. 1 and 2).

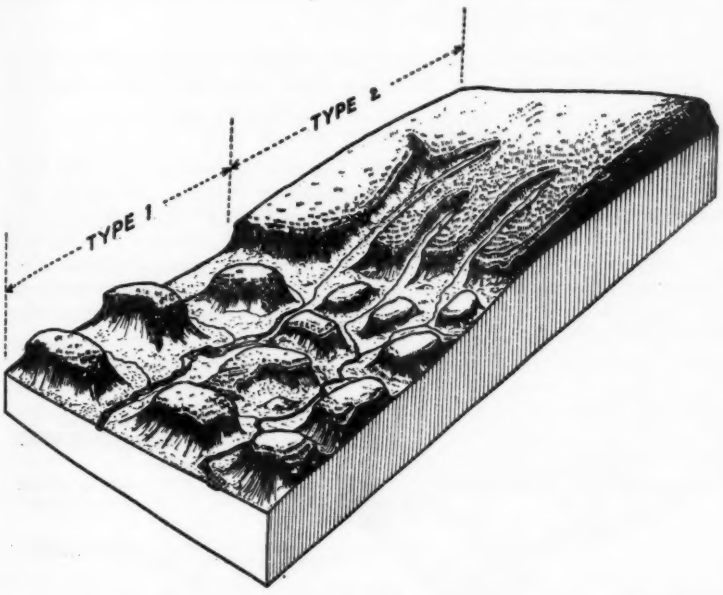

Fig. 3

The relationship between the two types of dissection. On the flat area deep peat is dissected by a close network of gullies of Type 1. On the slope behind the peat is thinner and the network of gullies of Type 2 is a more open one : on slopes the pattern tends to be a linear one.

Type 2 dissection affects peat on slopes, and the thinner peats on flat areas. On the latter it is often restricted to peat less than 5 to 7 feet deep although it sometimes occurs in deeper peat. The pattern of gullies is more open than in Type 1, largely because individual gullies rarely branch (Fig. 3). In the southern Pennines it is common on slopes, where the pattern and frequency of gullying vary in relation to ground slope, to peat depth on a given slope, and to a number of other factors.

(*b*) *Sheet erosion.* This is thought to be due to the action of a number of agents, among which rain, running water and wind are important. It often occurs in the following situations.

(i) On high and climatically exposed summit sites the vegetation mat often breaks up at an early stage in dissection, thus exposing large areas of bare peat. After this, sheet erosion is important, as well as dissection, as at Bleaklow Head.

(ii) On the highest moors, where the peat is very deep, peat flats sometimes develop during Type 1 dissection. After a certain stage gully incision slows down, but lateral erosion continues, so producing extensive horizontal peat flats as on parts of Kinderscout.

(iii) On flat and gently sloping cotton-sedge moors mud pools sometimes develop on the peat surface (Plate 4). Where the surface slopes sheet erosion probably occurs.

(iv) Sheet erosion of thin peat sometimes occurs on steep slopes. Examples are seen along the Snake road from Sheffield to Glossop.

(*c*) *Marginal face development.* The development of marginal faces on the edge of the peat mass is particularly common where the peat formerly thinned to a feather edge above an abrupt increase in ground slope. Such faces are common round the edges of many of the gritstone plateaux and benches, as on Bleaklow and Kinderscout, and on the flat topped interfluves in the upper Derwent valley. In these instances the peat mass is attacked from the margins, and in addition gullies often extend back from the face into the peat (Fig. 4).

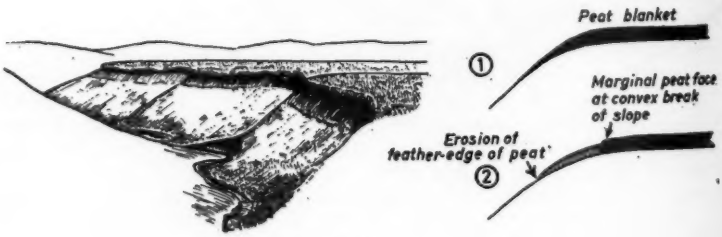

Fig. 4

The nature and development of a marginal peat face.

II. Mass Movement of peat often takes place on slopes. It may take the form of tearing and sliding of masses of peat, or, more catastrophically, a bog burst. Small scale tearing and sliding has been fairly common on the steeper slopes in the southern Pennines. The arc-like peat faces marking the tears (Fig. 5) are often situated at convex breaks of slope.

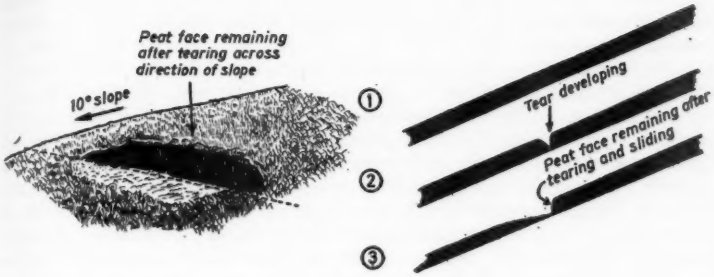

Fig. 5

The nature and development of a peat face by tearing and sliding of the peat blanket on slopes.

The Distribution of Erosion

The distribution of peat and of active peat dissection in the southern Pennines have been mapped from air photographs, together with ground survey. By this method it was possible to map the erosion more accurately and in more detail than the extent of the peat itself. The distributions were plotted from 1 :10,000 vertical air photographs on to 1 :25,000 Ordnance Survey maps, which were reduced photographically in the preparation of the final maps. The conclusions given here concerning the distribution of the several types of erosion, and the stages reached in erosion at the present time, are based on a study of the Pennines as a whole, but they are exemplified in the southern Pennines.

The Distribution of Dissection

With the aid of the accompanying maps, covering the peat areas to the south of Longdendale, the present distribution of dissected peat will be described and interpreted. Only features of the distribution of erosion apparent in this area are discussed. It is hoped to examine the distribution of erosion more fully but in a similar way in the whole of the Pennines in a later paper.

The maps (Figs. 1 and 2) show clearly that both types of dissection are taking place most extensively in the deeper peats of the highest and wettest areas. Here Type 1 dissection is common, and Type 2 usually shows a relatively high gully frequency. On Bleaklow and Kinderscout, where the peat is usually more than 6 feet deep, and on the flatter areas often more than 10 feet deep, only a few small islands of peat are quite unaffected by gullying. Even considering the Pennines as a whole these are both areas of quite spectacular peat erosion (Plates 1 and 3). By contrast, on the lower moors large areas of peat of moderate depth are not affected by gullying. The Axe Edge area, and the flat topped interfluves of upper Derwentdale (Figs. 1 and 2, Plate 2) offer examples

of such undissected peats. In Upper Derwentdale a transition between the high and the lower moors can be seen. Starting on the Bleaklow plateau, the severely eroded peat of the high moors is well examplified. Moving eastwards one passes onto lower, drier moors with thinner peat and much less extensive erosion. Towards the edges of the flat topped interfluves Type 2 dissection is fairly common, but the peat of the flattest central part is unaffected, or shows only early stages of Type 1 dissection. Finally, the moors have a thin, peaty soil, except in hollows, where deep peat is still found at a low altitude, as in the Derwent Edge district. Thus it may be concluded that *the extent of active erosion at the present time increases with altitude.* This is perhaps related to the greater depth of peat at the higher altitudes, which may in turn be related to the higher rainfall, a factor which may be responsible also for an increased power of water erosion at the higher levels.

Another conclusion about the distribution of dissection which is illustrated by the maps (Figs. 1 and 2) is that *Type 1 dissection is restricted in distribution to deep peat on flat areas.* An explanation has been suggested elsewhere(9) and is summarised here. It appears that Type 1 dissection occurs only on sites where there was once a hummock-pool complex on the bog surface. This is based on the observation that many of the gullies of Type 1 systems head in pools or depressions on the peat surface. These would form many lines of weakness on the surface, which could be developed into gullies when the pools were drained. The close and intricate pattern of the gullies reflects the pattern of the pools which preceded them. Both the Type 1 systems and the few remaining hummock-pool complexes have been observed only in deep peat on flat areas. It is suggested that a pool complex tends to develop only when the peat attains a depth of 5 to 7 feet on areas of less than 5 degrees slope. The pools may be drained with the onset of gullying at any time thereafter: some are drained almost immediately but others survive while peat accumulates to a greater depth. Once erosion begins, however, peat accumulation almost ceases, for the peat surface becomes fairly well drained, and thus the approximate depth of the peat at the onset of erosion is known.

It is thought that this explanation of the restricted distribution of Type 1 dissection is applicable throughout the Pennines. C. E. Moss(10), who also worked in the southern Pennines, suggested that intensive dissection occurs where two streams head onto each other. R. H. Johnson(11), working in the same area, offered a similar explanation: "Where such streams compete actively for the same area of peat moss, the moss will be completely dissected." Considering the Pennines as a whole, however, intensive dissection (or Type 1, which appears to be the same thing) is not restricted to such sites, so another explanation is required.

The proportion of dissection classified as Type 1 is greatest in the highest areas. This is due to the fact that the proportion of the peat on flat and gently sloping ground which attains the minimum depth required for Type 1 dissection is greatest in the highest areas. Type 2 dissection also is often more intensive, that is, gullies occur more

frequently on the higher than on the lower moors, and this is possibly related to the greater depth of peat on a slope of a given angle the higher the rainfall. According to W. H. Pearsall, "On the steeper upland slopes, too, peat becomes unstable when a certain depth is exceeded. A deep peat-bog on a slope is comparable to a drop of viscous fluid. It will either flow or develop its own drainage system"(12). The present writer suggests that the higher the rainfall the more likely is it that this "certain depth" will be exceeded. The high rainfall at high altitudes may be significant also in giving a greater power of erosion here. Type 1 dissection is uncommon on the lower moors, and where it occurs it is usually confined to the flattest central sector of an interfluve, where peat depth and slope are both suitable. Elsewhere, in such situations, traces of pool complexes are sometimes found (Plate 2).

While stage in dissection has not been mapped from ground survey and the examination of air photographs it is clear that in this area *erosion is on the whole most advanced on the highest moors.* The stage of dissection reached, as well as its type, varies with altitude. Advanced and late stages of Types 1 and 2 are usual on Bleaklow and Kinderscout. On the lower moors Type 2 is sometimes advanced, with the gullies cutting to the peat base; Type 1 is not only uncommon but where it does occur it is usually in an early stage. This contrast in the stages of erosion reached at the present time may be related to the fact that the peat on the highest areas would reach the minimum depth required for the onset of Type 1 dissection at an earlier date than the peat at lower altitudes. Therefore erosion may have been in progress for a longer time on the higher moors, although in some parts it did not start until up to 15 feet of peat had accumulated. To fully understand the differences in stage reached in dissection, however, one must consider also the possibility of a greater power of erosion in the higher, wetter areas, where erosion may proceed much more rapidly than it does on the lower moors. The main areas of undissected peat at the present time are therefore the flatter parts of the lower moors (Figs. 1 and 2).

Within the limits set by climate, the distribution of dissection is controlled by landform. The relationships between the distribution of Type 1 and Type 2 dissection and landforms have been mentioned earlier; some relationship between the stage of dissection reached at the present time and landform can also be discerned. Other things being equal, peats in particularly "vulnerable" landform situations are liable to be affected by dissection before those in more protected situations. The former appear to include sites adjacent to steep slopes with swiftly flowing streams, valley head areas, alongside pre-existing stream courses, and rather high and climatically exposed summits. Peats on valley-side benches and gritstone plateaux are to some extent protected, for springs often rise at the base of the grit, and their streams do not readily erode headwards into the peat on the bench above.

The Distribution of Other Types of Erosion

The distribution of some types of sheet erosion, and of mass movement also appear to be related to landforms. For example, many of the peat faces developed by mass movement on slopes are located at convex breaks of slope, which might be places of tension in peat covering the whole slope. Biotic activities, however, may be important in some

cases. Burning the vegetation, which normally forms a fairly tough mat at the surface may have favoured mass movement on some steep slopes. In the case of sheet erosion due to mud pool development on the cotton sedge moors, the erosion may be attributable to the biotic activities responsible for the change in vegetation to cotton-sedge. The mud pools have been discussed by M. E. Phillips([13]), but she could not give definite conclusions regarding their origin. The sheet erosion on summits appears to be directly related to climatic exposure.

Conclusions Regarding the Distribution of Erosion

The distribution of all types of erosion appears to be more closely related to physical than to biotic factors, with the possible exceptions of some types of sheet erosion and mass movement, and a few gullies starting off as surface runnels. As a rule there is no direct or obvious relationship between the distribution of erosion and biotic activities, but it is not denied that they may have had some influence on the date of onset of erosion. In this context the greater peat depth at which Type 1 dissection has started on Bleaklow and Kinderscout as compared with the lower moors should be mentioned. On the former it is sometimes seen in peat 10 to 15 feet deep, while on the latter it is often starting at about the minimal depth for onset (5 to 7 feet). The recent very great changes in vegetation—to cotton-sedge—*may* have had some influence on this onset of erosion at a relatively early stage. The continued accumulation of peat to a greater depth on the higher plateaux may have been favoured by less biotic activity there in the past. Alternative explanations for these differences can be offered; for example, more rapid accumulation on the higher areas or postponement of the development of the pool complex preceding Type 1 dissection until a greater depth of peat had formed could have occurred and been significant. However, biotic activity has certainly been considerable on the peat moors, and, following Dr. Conway ([14]), it must be considered in any attempt to understand the erosion. It is perhaps easier to evaluate the influence of biotic activities if one considers a larger area than that discussed here. It is hoped to do this in a later paper covering the Pennines as a whole.

Acknowledgments

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NOTES

(1) The lower depth limit for peat recognised by the Geological Survey is followed; that is, an organic accumulation at least 2 feet in depth.

(2) Ordnance Survey, Great Britain, 10 miles to 1 inch map of Annual Average Rainfall, 1881–1915.

(3) V. M. Conway, Stratigraphy and pollen analysis of southern Pennine blanket peats, *Journal of Ecology* 42 (1954) 117–147.

(4) Ibid.

(5) V. M. Conway, Ringinglow Bog near Sheffield, *Journal of Ecology* 34 (1947) 149–181.

(6) W. H. Pearsall, *Mountains and moorlands* (London, 1950) p. 160.

(7) C. E. Moss, *The vegetation of the Peak District* (Cambridge, 1913) p. 187.

(8) M. Bower, Peat erosion in the Pennines, *Adv. of Science* 16, No. 64 (1960) 325-331.

(9) Ibid.

(10) C. E. Moss, (1913) op. cit. p. 89.

(11) R. H. Johnson, Observations on stream patterns on some peat moorlands in the southern Pennines, *Mem. and Proc. Manchester Phil. and Lit. Soc.*, 99 (1957–8) 1–9.

(12) W. H. Pearsall (1950) op. cit. p. 205.

(13) M. E. Phillips, Studies in the quantitative morphology and ecology of *Eriophorum angustifolium* Roth, *Journal of Ecology* 42 (1954) 187–209.

(14) V. M. Conway (1954) op. cit.

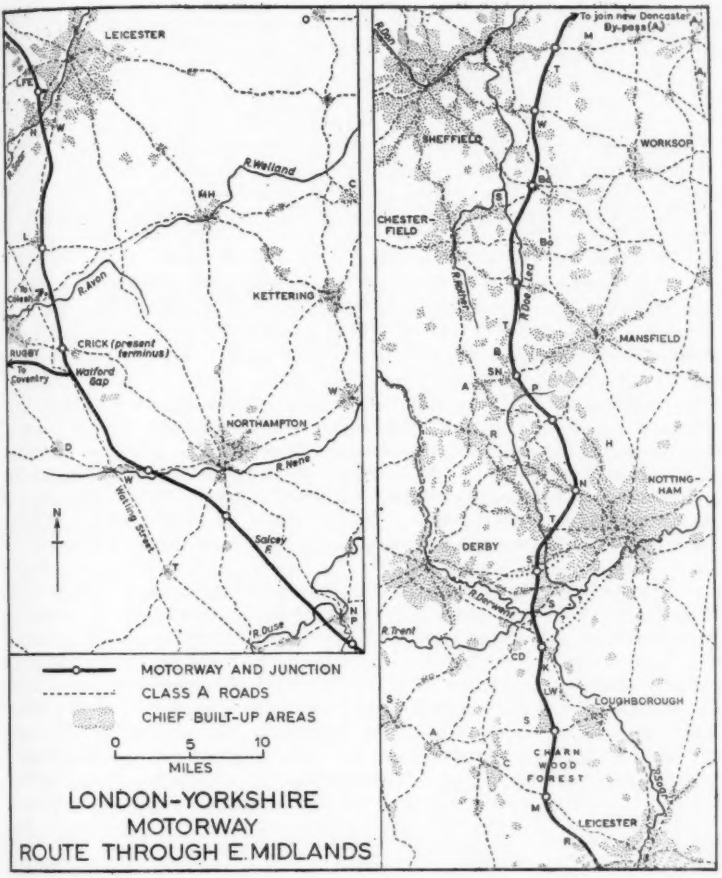
THE LONDON-YORKSHIRE MOTORWAY: ITS ROUTE THROUGH THE EAST MIDLANDS

R. H. Osborne

On 2 November, 1959, the first portion of Britain's first motorway, the M1, was officially opened after being under construction only since March the previous year. The completed section, forming the greater part of a London-Birmingham Motorway, extends for about fifty miles from the new St. Albans By-pass, near the village of Slip End, south of Luton, to a point near the village of Crick, in Northamptonshire. It has been claimed that "until that windy March day when history was made at Slip End no similar engineering work of comparable magnitude had been seen in England since the days of main line railway construction ended."(1)

The construction of the new motorway, designed for the Ministry of Transport and Civil Aviation by Williams and Partners and built by the firm of Laing at a cost of £16 millions, was characterized by the use of helicopters and massive earth-moving equipment, the latter valued at £5 millions, and by the relatively modest labour force involved, which reached a peak of only 4,700. The volume of earth removed amounted to 11½ million cubic yards and the number of bridges of all kinds needing to be constructed reached 134, although many of these are, admittedly, small farm access bridges. Major bridges include those taking the motorway under or over existing railway lines and three viaducts crossing the flood-plains of the Ouse, its tributary, the Lovat, and the Nene. The motorway consists of two 36′ three-lane carriageways with a "central reserve" of 15′ and outer "hard shoulders" of 8′. Seven two-level junctions, each with four "slip roads", give connection with important Class A roads crossed by the line of the motorway. Four "service areas", incorporating filling stations, cafés, and vehicle parks, are already provided or planned for at intervals along the route.

The completed portion of the motorway crosses transversely the low, rolling, dissected Scarplands of the English Plain, developed on Cretaceous and Jurassic rocks, and typified by the alternation of clays, sands and calcareous rocks, frequently covered, however, by glacial drift. Cuttings, viaducts and embankments enable a ruling gradient of 1 in 50 to be observed, although the maximum planned gradient was 1 in 30, and there is a minimum horizontal curvature of 2,865′ radius. The maximum height of the route above sea-level would appear to be no more than about 500′ and even this altitude is rarely encountered. Sizeable built-up areas are relatively sparse in that part of the country through which the M1 passes, and can therefore be easily avoided. The only exception occurs in the Luton-Dunstable district, where the motorway cuts through a zone of suburban housing situated between the two towns, in order to make the descent from the chalk scarp of the Chilterns. The easiest routes are, unfortunately, occupied by the two towns themselves. The motorway then runs successively across the Gault Clay, the Lower Greensand and the Oxford Clay, and so reaches Newport Pagnell (*NP* on the accompanying map), situated at the confluence of the River Lovat (or Ouzel) with the Ouse.



Beyond Newport the motorway crosses the Oolite series, touching the western edge of Salcey Forest and here entering Northamptonshire, before descending to the valley of the Nene, cut into the Upper and Middle Lias rocks, at a point several miles upstream from Northampton. The route now swings close to the line of the old Roman road of Watling Street (A5), with which it has, in fact, run parallel so far, and, in company with Watling Street, the Grand Union Canal, and the railway lines from Euston to Rugby and from Northampton to Rugby, it makes for the Watford Gap (450′-500′) in order to descend to the Lower Lias claylands lying to the north. The Watford Gap, which takes its name from a neighbouring village, results from river dissection, especially by dip-slope tributaries of the Nene, but there has been a further lowering due to the overflow southwards of glacial melt-waters. Later deposits of drift cover the gap itself and the descent from the low escarpment.

The canal and the two railway lines proceed northwards through the gap by means of tunnels, but it is noteworthy that both the old line of Watling Street and the M1 go over the gap itself; indeed the M1 runs directly above the tunnel carrying the line from Northampton. Here also the spur linking Birmingham to the M1 leaves the motorway and proceeds westwards over the other railway tunnel (Euston-Rugby). This spur, which has a dual two-lane carriageway, extends to a new by-pass at the village of Dunchurch, where it joins the A45, running to the south of Coventry. The present end of the M1 lies about two miles north of the Watford Gap between Crick and Watling Street, to which it is linked by the A428.

The proposed route for the remaining part of the motorway, extending for about 100 miles from Crick to the Doncaster By-pass, has now been published, but so far there is no sign of a decision by the Government regarding actual construction work. The delay has been partly due to the controversy over the route to be followed through Charnwood Forest in Leicestershire. In the meantime, unfortunately, the labour force and equipment marshalled for the first part of the motorway have been disbanded. The constructional design for the extension will follow closely that for the completed section, and apart from the section through Charnwood Forest the height above sea-level would again appear to be rarely above 500′. North of the Trent the route has been greatly affected by the need to avoid built-up areas wherever possible.

The extension north of Crick will run firstly through Lower Lias country, crossing *en route* the Warwickshire Avon and so entering Leicestershire. A second spur running in the direction of Birmingham has been proposed just north of the Avon, linking the M1 with Coleshill. It thus appears that Birmingham will have two links with the motorway, one running south of Rugby and Coventry, and the other running north of them. For about eight miles the motorway will now run by the side of the former Great Central railway line from Rugby to Leicester, passing close to Lutterworth in the process, but south of Leicester the motorway will turn north-westwards to reach the River Soar at a point between the two large villages of Narborough and Whetstone. On its approach to Leicester the motorway will have left the Lower Lias for the very similar type of country presented by the Keuper Marl. Continuing north-westwards the motorway will cross the Soar and the Fosse Way (A46) and will then pass through the heart of the rural enclave of Lubbesthorpe parish before crossing the Leicester-Hinckley Road (A47) at the suburban district of Leicester Forest East. After skirting the large villages of Kirby Muxloe and Ratby the motorway will enter the wooded upland of Charnwood Forest, consisting of ancient Pre-Cambrian rocks largely covered with Keuper Marl.

Vigorous discussion took place over the route to be taken north of Leicester. A route directly through the heart of Charnwood— a valuable Midland "lung"—was strongly opposed and so was an alternative route along the lower Soar valley, already followed by the main road and rail communications linking Leicester with the north. A third route, agreed by the County Council, is the one shown here and the one likely to be adopted. It runs through the western part of the Forest between Markfield and the small town of Shepshed, and climbs to a height of

700', the highest altitude reached along the whole length of the motorway. North of Shepshed the M1 will descend to Keuper Marl country, passing the village of Long Whatton, and reaching, at Kegworth, the widest flood-plain section (four miles wide) to be negotiated. This is the flood-plain of the Trent, which is joined within a short distance of each other by three tributaries: the Soar, the Derwent and the Erewash. The crossing of the Trent and its broad flood-plain will entail the building of a major viaduct at Sawley, just west of the present bridge. At Sawley the motorway will enter Derbyshire and proceed northwards over the two busy roads linking Derby and Nottingham and also over a by-pass, now under construction, lying between the two and running south of Sandiacre. An earlier route proposed for this section apparently involved a crossing of the Trent further downstream, but the difficulty of securing a suitable route through the built-up areas west of Nottingham seems to have been responsible for the present line being adopted.

Beyond Sandiacre the motorway will leave the Keuper Marl and pass on to the Coal Measures, thus entering the East Derbyshire and Nottinghamshire coalfield. At the same time it will veer eastwards into Nottinghamshire across the River Erewash, at a point just south of the Stanton Ironworks, and will then cross the Nottingham-Ilkeston (A609) road at the village of Trowell. The reason for this detour is presumably to avoid the industrial Erewash valley, where an easy route would have been difficult to find. The route chosen to the north-west of Nottingham is reminiscent of that through the western outskirts of Leicester in that a rural enclave lying between two main roads will be violated. North of Trowell the M1 will thus run through a rural tract situated between Trowell and Nuthall, a suburbanized village on the road leading north-westwards from Nottingham to Ripley (A610). This rural tract effectively separates Nottingham from Ilkeston in the Erewash Valley. North of Nuthall the route will cut through another tract of open country, occupying a lofty position between the Erewash valley to the west and the Leen valley to the east, in which is situated the industrial town of Hucknall.

From a point south of Nuthall the M1 will be running along the outcrop of the Permian rocks, which overlie the Coal Measures to the east, but in order to make good its detour and possibly to avoid the urban complex of Mansfield, the motorway will swing away north-westwards back into Derbyshire and back on to the Coal Measures, crossing the upper Erewash at the Derbyshire mining village of Pinxton. Other mining villages—South Normanton, Blackwell, Tibshelf—will be passed on their eastern side, and then the motorway, having crossed the watershed between the Trent and Don drainage systems, will follow a route along the west side of the valley of the small River Doe Lea, a tributary of the Rother. In the Doe Lea valley the Permian rocks (Magnesian Limestone) rise up as a prominent escarpment to the east, and the motorist will have contrasting views of Hardwick Hall and Bolsover Castle on the escarpment and mining villages in the valley. Staveley, near the confluence of the Doe Lea with the Rother, will be avoided, however, and the route will turn north-eastwards to run at the foot of the escarpment. Beyond Barlborough the motorway will enter Yorkshire, thus leaving the East Midland counties, and will then continue northwards past the mining villages of Wales and Thurcroft. Finally it will

turn eastwards to reach the Magnesian Limestone by an easy ascent at a point south-west of Doncaster in order to join the new by-pass, which will be part of the improved Great North Road (A1).

The economic repercussions of the motorway on the East Midlands cannot as yet be fully assessed. Besides providing a fast, modern means of communication between London and Yorkshire and between London and Birmingham the project will, of course, be of considerable significance for shorter journeys, especially perhaps in the industrial zone stretching northwards from Leicester. Journey-times should be considerably shortened between, for instance, Nottingham and Chesterfield and Doncaster and Derby.

The likely effect on industrial location is still obscure, especially since planning policy might conceivably frown on proposals for new industrial sites in close proximity to economically strategic motorway junctions, if only because many of these occur in rural country. Distribution or collection points for manufactured goods or components might also be powerfully attracted to the motorway. To a certain extent planning policies may be helped rather than hindered, however, as, for instance, if the motorway were to encourage new industry in the older Derbyshire coal-mining areas, or if it were to encourage an orderly dispersal of population and industry to some of the smaller towns. Newport Pagnell, Lutterworth and Shepshed, to name only the most obvious examples, could well stand to gain in this respect.

Repercussions might also occur in the settlement pattern, particularly where the motorway passes through the more densely populated areas. For persons whose work involves much travelling by car over, say, a business circuit extending from Sheffield to Northampton there will be an obvious attraction to residential areas within easy access of the motorway, especially in the triangle Derby-Nottingham-Loughborough. Within the latter area it may be suggested that two of the most likely locations for an increased demand for new housing of such a middle class character will be the Sandiacre and Kegworth districts. The former lies just west of the Erewash, where the motorway will meet the improved Derby-Nottingham road "axis" at its mid-point, while the latter, overlooking the flood-plain of the Trent, will enjoy somewhat similar advantages if the proposal—as yet unofficial—to make an improved road link with Nottingham on the south side of the Trent is carried out. The Kegworth area might also enjoy a further advantage if a major East Midlands airport is developed, as is now suggested by several local authorities, at the large disused R.A.F. aerodrome at nearby Castle Donington. Whatever the detailed effects may be, there seems little doubt that the London-Yorkshire motorway will not only be a striking addition to the landscape, but may in time also lead to interesting changes in the industrial and settlement geography of those parts of the East Midlands through which it passes.

NOTE

(1) Rolt, L. T. C., *The London-Birmingham Motorway* (1960), pub. Laing. See also *London-Yorkshire Motorway* (1959), pub. Sir Owen Williams and Partners.

RECENT FLUCTUATIONS IN MILK PRODUCTION: THE EXPERIENCE OF THE EAST MIDLANDS

F. A. Barnes

The salient patterns of milk production and distribution in England and Wales, and their evolution up to 1955, have been examined in a paper published by the Institute of British Geographers(1). It was there suggested that in view of the check in the increase of consumption of fluid milk in 1951, the continuing strong rise in milk production represented a potential threat to the prosperity of the dairying industry, and that immediate steps to counteract it called for further price manipulations. Between 1950-1 and 1954-5 the proportion of the milk sold off farms which was consumed in liquid form had fallen from 90 to 82 per cent., and was continuing to fall, so that there was in prospect a rapid reversion to the difficult situation of the 1930s, when less than 70 per cent. of milk sold was consumed as liquid milk. In fact, by 1957 the proportion had fallen to about 72 per cent. Any such substantial surplus over liquid requirements has to be converted into milk products, most of which are exposed to severe overseas competition. The surplus production can therefore command only a low price, and as a result it must be heavily subsidised by the liquid side of the industry. Any increase in the retail price of milk to cover this might only reduce liquid consumption and aggravate the situation. Even assuming some increase in liquid consumption and in high-grade alternative uses of milk, this economic problem could apparently be resolved only by slowing down the rise in milk production, and concentrating "surplus" production into the periods and places where it would be cheapest.

Already in 1951 the price status of milk relative to some other farm products like beef was being down-graded from its very high wartime position, but the steps taken up to 1955 had been insufficient to check production materially, based as it now was on the improvement of herds and husbandry. Later statistics show that a general fall in milk producers' prices from 1955 to 1957 halted the expansion of sales off farms, and led to a decline beginning in the summer of 1957 (Fig. 1). In order to achieve stability the producers' price was immediately raised slightly, and this continued until, in the late summer of 1959, milk sales off farms began to rise again. In October, for the first time in 1959, milk sales reached the figure of the corresponding month in 1958. In November, 1959, they were 1.2 per cent. above those of the previous November; in December they were 8.3 per cent. above the previous December; and by March, 1960, the sales were 12.3 per cent. higher than those of a year earlier. To allow for a surplus sufficient to support a useful manufacturing industry without burdening the fluid side too heavily for its continued prosperity, it seems desirable that production should be stabilised at some such figure as 1,800 million gallons a year, that is, at about the present level, and that of 1956(2). It is clear that this will be achieved mainly by a continual manipulation of the producers' price.

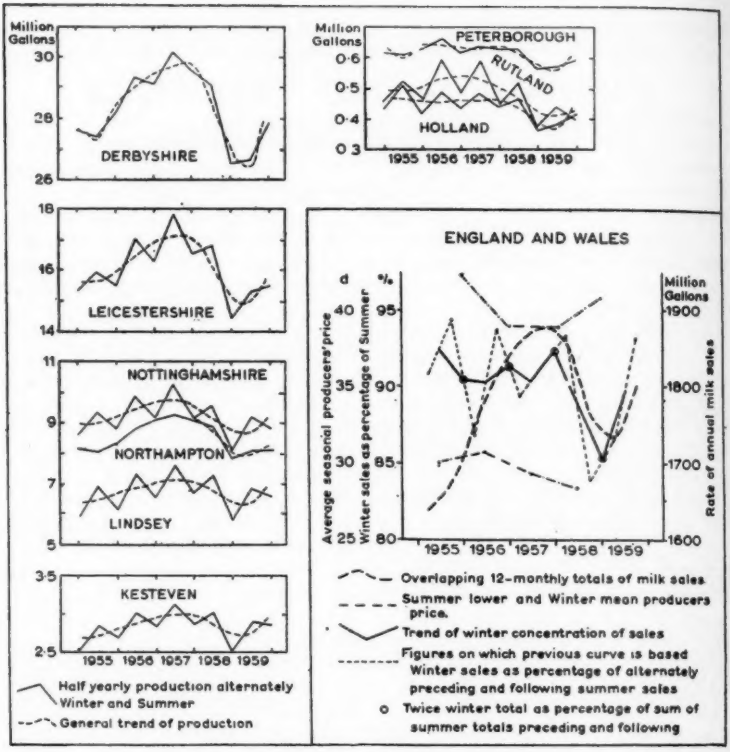


Fig. 1

Trends in milk production in recent years.

The East Midlands as a whole (3) is not among the heaviest milk producing areas of the country, but it shows a marked internal differentiation, with heavy production in southern Derbyshire, and very light production in Fenland (Fig. 2). It is interesting to note that it reacted strongly throughout to the recent price change against milk; indeed, a comparison of the sales off farms in September, 1958, with those of September, 1959, shows that only Anglesey matched the degree of decline in Leicestershire, Rutland, Northamptonshire and Holland (Lincolnshire), and each county unit in the East Midlands had a greater decline than those in the west, north, south, and most of the east of the country. This may well relate to the suitability of much of the region for feeding beef cattle as an alternative to dairying, although the local effects of the drought of 1959, and the possible effect of the imminence of compulsory T.T. herds would have to be evaluated in a full interpretation. In the resumption of increased production the "hunting shires" lagged behind the average for the country during the winter, but now appear to be catching up (Table 1). The timing of changes in the trend of milk sales in each larger county of the East Midlands closely follows that in England and Wales, although the smaller producers show differences (Fig. 1).

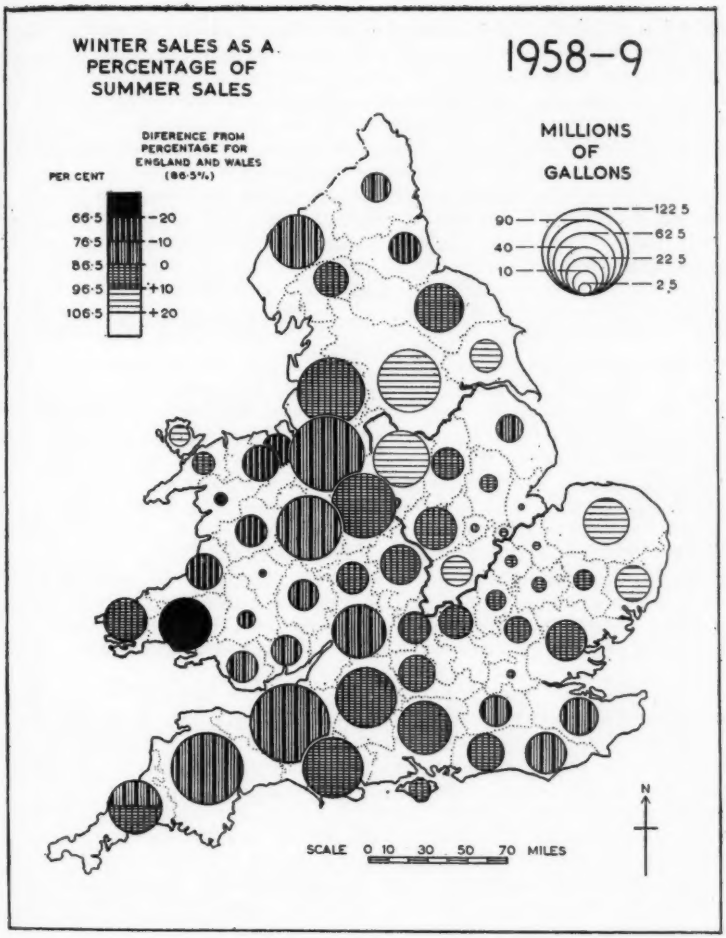


Fig. 2

Milk sales and seasonality by counties, 1958-59.

Winter milk supplies are safeguarded by paying the farmer much higher prices than for more cheaply produced summer milk. The winter-summer price differential is fixed at such a level that summer milk tends to predominate on grass farms, especially in the west, and winter milk on arable farms, especially in the east (Fig. 2). In the 1930s the average producer price for the winter half year was about 1.3 times that for the summer half year, but it was increased to almost 1.7 times early in the war (with consumer subsidy). Subsequently the differential has been reduced, rapidly at first, and then levelling off at 1.4 to 1.5 in the late 1940s and early 1950s. A consequence of this still high post-war differential was a continuing rise in the proportion of annual sales in winter, from about 45 per cent. in the 1930s to 46.8 in 1946-7, 47.6 in

1954-5, and, after a check through poor winters, to 48.3 in 1957-8. Such a high proportion of winter milk is desirable only while liquid consumption roughly matches production, for an increasing surplus includes increasing quantities of expensive winter milk which is no more valuable than summer milk to the manufacturer. Therefore action has been taken also to reduce the seasonal differential, presumably in the expectation that this should increasingly concentrate surplus production on grass farms in summer, when milk is richest and cheapest. The differential of 1.4 in 1955-6 was reduced to 1.3 in 1956-7-8, and to 1.2 in 1958-9, the lowest since the Milk Marketing Board came into existence in 1933.

TABLE 1

COMPARISON OF MILK SALES IN CERTAIN MONTHS WITH THOSE A YEAR EARLIER

	September 1959/1958	*December 1959/1958*	*March 1960/1959*
England and Wales	— 3·9	+ 8·3	+12·3
East Midlands	—11·8	+ 7·4	+13·0
Derbyshire	—10·5	+ 5·4	+10·4
Nottinghamshire	— 9·0	*+11·7*	*+14·1*
Leicestershire	*—16·0*	+ 7·2	*+14·2*
Rutland	*—22·9*	+ 3·1	*+18·5*
Northamptonshire	*—14·1*	+ 4·4	+11·3
Soke of Peterborough	*—13·4*	+ 5·3	+ 9·8
Lincolnshire, Holland	*—17·2*	*+11·9*	*+20·6*
Kesteven	— 7·8	*+14·4*	*+17·5*
Lindsey	— 9·6	*+13·6*	*+19·7*

Figures in italics are larger than both the national and regional averages.

The effect of these price changes cannot be analysed simply, but certain tentative conclusions can be drawn. The winter proportion of sales was maintained until 1957, when it declined sharply along the total sales (Fig. 1). More recently it has risen again to almost its earlier level. When changes in winter concentration between 1954-5 and 1958-9 are plotted against winter concentration in 1954-5 for counties, a definite tendency is revealed for counties with a high winter concentration to reduce this to a greater extent than those with a low winter concentration, though with some exceptions. Only one small county, Holland, with an above-average winter concentration in 1954-5 subsequently increased it. The greatest proportional declines were in the east, but decline was widespread in the west, though not in the "new" producing areas of the western peninsulas and north Yorkshire. The changes in the East Midlands were not outstanding.

When the actual changes in milk sales as between the winters of 1957-8 and 1958-9 are examined, it is found that decreases occurred almost everywhere, but were greatest in the west, and generally least in strongly arable districts. In the East Midlands they were everywhere somewhat above the national average. The summer changes as between 1958 and 1959 show a more clearly defined regional pattern; the decreases were concentrated especially in the Midlands, and particularly the north-west Midlands, including Derbyshire, and in the western peninsulas, while there was an increase in north-west England and parts of the south-west and south. If the figure by which a county's percentage decrease in winter production between 1957-8 and 1958-9 exceeds the

country's average is combined arithmetically with the figure by which its percentage increase in summer production between 1958 and 1959 exceeds the average, a crude index is derived which should indicate its tendency to turn to summer production over the period 1957-9. This tendency is found to have been greatest in the west and north of the country, and least in the Midlands and part of the east. The grouping of Derbyshire, Leicestershire, Rutland and Northamptonshire with Fenland, East Anglia and east Yorkshire suggests that in the former group of East Midland counties there was a special tendency to react to changes in the seasonal price differential by turning to cattle grazing in summer, a reaction which is understandable in view of the favourable conditions they enjoy for beef production. This is a reminder that the association of arable farming with winter milk predominance, and of grass farming with summer milk predominance are not simple relationships.

The relaxation of the price discrimination against milk which has led to the resumed increase in sales off farms during the past year has had the further effect of again increasing the proportion of winter sales to a figure almost equal to that preceding the recent check. The crude figure is exaggerated because the winter of 1959-60 is compared with the previous summer in a time of generally rising output, and it may not be without significance that the counties showing the lowest proportional revival in December in the East Midlands were the more predominantly grassland counties of Rutland, Derby, Northampton and Leicester, while Derby and Northampton were still lagging behind the national figure in March. However, it is as yet too early to say whether any real impact has been made on the problem of concentrating surplus milk production in summer and on grass farms.

To summarise, a reduction of the producers' prices successfully checked the rise in surplus milk production in the summer of 1957, and the slight increase in prices which followed in turn checked the sharp fall in the late summer of 1959. This effect can be discerned in all the East Midland counties. It may well be that price manipulation in the interests of both producer and consumer will stabilise production at a figure near to 1,800 million gallons a year in England and Wales, but fluctuations about this figure, checked by close price control, are to be expected. The milk industry affords an interesting example of the methods of controlling production by the economic means of collective marketing and associated price control.

NOTES

(1) F. A. BARNES, The evolution of the salient patterns of milk production and distribution in England and Wales, *Institute of British Geographers, Transactions and Papers 1958*, No. 25 (1958) 167–195.

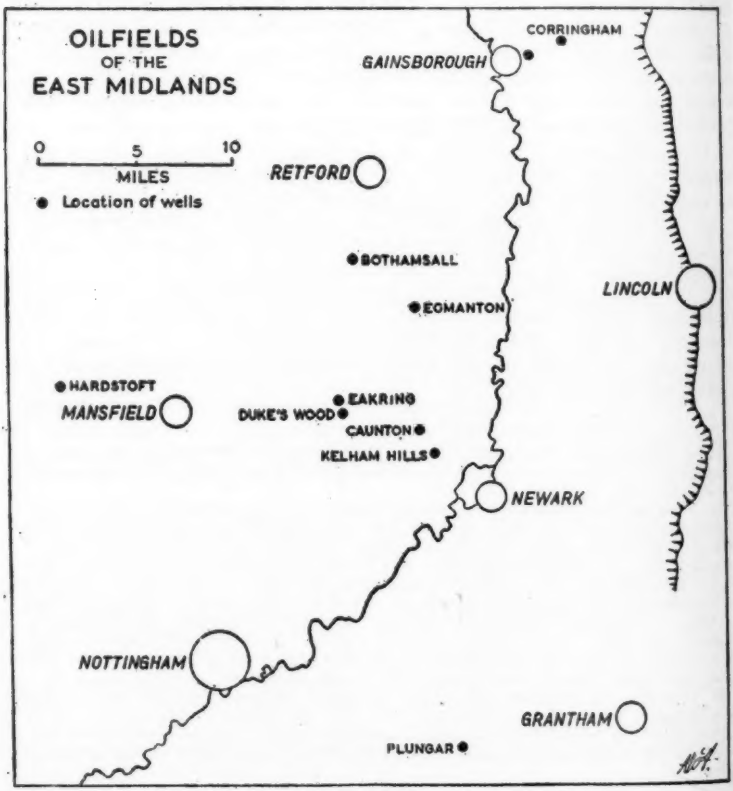
(2) This figure of the order of 1800 million gallons should be raised proportionately to any increase achieved in the quantity of milk sold in the liquid market. The Milk Marketing Board is at present making energetic efforts to increase liquid consumption, and with some success. The Standard Quality of milk for which the price is guaranteed to the producer, originally fixed in 1953, is the annual quantity required to satisfy the liquid market together with a safety margin. The government has this year responded to the resumed rise in liquid consumption by making the Standard Quantity subject to annual review. The Milk Marketing Board is not satisfied with the basis of the Standard Quantity, but it should be noted that the Board expresses primarily the interests of the milk producers.

(3) The East Midlands here designates the North Midland Standard Region with the addition of the High Peak of Derbyshire. The East Midland Region of the Milk Marketing Board includes Warwickshire and Bedfordshire and excludes Derbyshire (North-Western region) and Lincolnshire and the Soke of Peterborough (Eastern region).

EAST MIDLAND RECORD

Oil Discoveries East of the Trent

There are now nine small proved oilfields in Nottinghamshire and adjacent parts of the East Midlands. The two latest discoveries, not yet exploited, occur across the Trent near Gainsborough, one just east of the town and the other at the village of Corringham, about halfway between Gainsborough and the Lincoln Edge. At the former, oil was found in the Silkstone Rock of the Lower Coal Measures at a depth of 4,380 ft. and in the latter case in the Rough Rock of the Millstone Grit at 4,620 ft. These finds result from boring made in 1959 following another success the previous year at Bothamsall, near the new Bevercotes colliery in Nottinghamshire. Thus in addition to the now almost historic working at Hardstoft in north-east Derbyshire which began in 1919, the more recent discoveries include the Eakring and Duke's Wood field, Caunton, Kelham Hills, Egmanton, Bothamsall, and Plungar (Leicestershire). In all cases the oil occurs in anticlinal concentrations in Carboniferous strata. In 1959 the total output was a little over 80,000 tons, the crude continuing to be sent to Scotland for refining. Earlier references to the oilfields are to be found in the issues of this periodical for June, 1954, June, 1956, and December, 1958. Their distribution is shown on the accompanying sketch-map. K.C.E.



The Trent Valley Floods of January-February, 1960

During Sunday, 24 January, 1960, rain fell over the whole of the Trent basin. It was particularly heavy in the Birmingham area, where several stations recorded falls of over 2 inches between about 4.30 a.m. and 10 p.m. Most of the rest of the Trent's catchment area had between 1 and 2 inches of rain, and only parts of the upper Trent valley, and the lowest parts of the tidal reaches received less than 1 inch. Severe floods resulted from this rainfall in the valleys of the Tame and Soar, but the Dove and Derwent rivers rose to little more than bank-full.

While the peaks of this flood were still travelling down the various valleys, further rain fell over the whole catchment area in a series of storms which lasted, with various lulls, from about midnight, 27-28 January, until the early hours of Saturday, 30 January. Again it was heavy in the Birmingham area, where some stations measured more than 1 inch between midnight and the early afternoon of Thursday, 28 January, while between ½ and ¾ inch fell over most of the catchment area. Over the Torne's basin there were rainfalls of more than 1 inch during 28 January. The heaviest falls in the Derwent, upper Trent and lower Soar valleys occurred during Friday, 29 January. These later rains caused a renewal of flooding after a temporary subsidence, and since they were more prolonged, and ran off into already swollen rivers, the second phase of flooding everywhere lasted longer than the first, although the flood levels were generally little higher.

At Elford, on the Tame, which was affected by the very heavy rains of 24 January, the second flood peak was 1 foot lower than the first; but the first flood lasted only 45 hours compared with the 77 hours of the second. On the Soar, on the other hand, the second peak was about 1 foot lower than the first, but the second flood was again much the more prolonged. On the Derwent the second peak was only 6 inches higher than the first, but the river was above bank-full for 52 hours compared with the 16 to 17 hours in the first phase. The relative durations of flooding were generally similar on the Dove, where the second peak was about 10 inches higher than the first, on the Sow and on the Trent itself. At Shardlow, on the Trent, however, where the first flood peak was some 6 inches below the second, flooding was continuous from 7 p.m. Sunday, 24 January, until 9 p.m. Wednesday, 3 February : but a height of 2 feet above bank-full lasted for 21 hours in the first phase, and 85 hours in the second phase so that the periodicity of the flooding was similar to that on the tributary rivers. Further down the Trent at Colwick, the river was above bank-full for 71 hours in the second phase, and only 20 hours in the first phase, when the peak was 1 foot 10 inches lower. During the second flood period there was much anxiety about the possibility of an overflowing and collapse of the Shelford flood bank, but this was averted by sand-bagging although the water was lapping the top of the sandbags at one time, and there was considerable seepage.

In the tidal reaches of the Trent the effect of a freshwater flood peak travelling downstream depends upon tidal conditions. The highest tides of the period occurred on the evening of 28 January and the

morning of 29 January, but the most dangerous possible situation in respect of flooding did not materialise because the flood peak did not arrive from up-river until 4 days later. The tides between 28 January and 3 February, however, were in fact about 1 foot higher than predicted, and water spilled over the Beckingham marshes opposite Gainsborough on 9 tides during this period. The tides ponded up the freshwater coming down-river, and all the wash lands between Cromwell (near Newark) and Gainsborough were filled up with flood water. The river level rose rapidly, and the left bank was overflowed in the Laneham area, causing 6,000 acres to be flooded. Fortunately the rise was checked before Dunham village was flooded. During the night of 2 February a strong south-west wind produced waves which breached the Bole Ings bank on 3 February, but by this time the river level was falling, and there was little additional flooding.

H.R.P.

OBITUARY

Mr. G. J. Cons

Geographers in the East Midlands, particularly those associated with the University College of Nottingham during the second world war, will regret the death in January of this year of Mr. G. J. Cons, M.A., Senior Tutor and Principal Lecturer in Geography at Goldsmiths' College, London. On the outbreak of war, in accordance with a pre-arranged scheme for the evacuation of educational institutions from London, both Goldsmiths' College and the University Institute of Education moved to Nottingham. Despite difficult circumstances, Mr. Cons and his department shared with fortitude the very restricted accommodation offered by the Nottingham Geography department. The fact that the two departments worked harmoniously together for no less than seven years, combining in many activities to their mutual advantage, was largely due to the generous, wise and liberal-minded personality of Mr. Cons. As a vigorous and stimulating teacher, his work at Nottingham will long be remembered, while as a kindly, considerate and helpful colleague he earned the highest respect and affection. The University community at large will not forget the invaluable contribution made by Mr. Cons towards the maintenance of cultural activities during dangerous days, especially his showing of first-rate documentary and other films, in the direction and editing of which he himself was an acknowledged expert.

K.C.E.

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